BY ORDER OF THE COMMANDER

AETC MANUAL 11-206
29 SEPTEMBER 1995

Flying Operations

MISSION EMPLOYMENT--PRIMARY FLYING, T-3A

This manual implements AFPD 11-2, *Flight Rules and Procedures.* It contains the basic principles and procedures that apply to all personnel operating T-3A aircraft under operational control of Air Education and Training Command (AETC). While the manual basically addresses the pilot training student, all aircrews must perform maneuvers in the manner described in this manual and AETCI 11-205, *T-3A Aircrew Operational Procedures.* When you encounter situations not specifically covered by these publications, use safety considerations as a guide in determining the best course of action. Procedural detail of maneuvers in this manual may vary from those in other AETC publications. When differences exist, AETCI 11-205 and this manual take precedence. The 12th Flying Training Wing (12 FTW) may supplement this manual with procedures for its unique mission requirements. The 19th Air Force Commander (19 AF/CC) is the approval authority for all supplements (and changes to supplements) to this manual. Submit recommendations to change this manual on AF Form 847, **Recommendation for Change of Publication (Flight Publications),** to Standardization/Evaluation (19 AF/DOV), 73 Main Circle, Suite 1, Randolph AFB TX 78150-4549. (Attachment 1 contains a list of the abbreviations used in this manual.)

SUMMARY OF REVISIONS

This revision contains numerous revisions to every chapter within this manual and must be carefully reviewed. More substantial changes are: clarifies portions of the before starting engine and starting engine procedures, before taxi procedures; and taxi procedures; clarifies transfer of aircraft control; adds additional guidance on adjusting rudder pedals; provides additional information on over and undershooting final turn stalls; expands and changes the entry and recovery procedure for a spin prevention; specifies 45 degrees as the maximum bank angle in the final turn; incorporates the previously approved Spin Training Program in chapter 8.

Paragraph

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Chapter 1

GENERAL INFORMATION

1.1. Introduction. The objective of this manual is to provide techniques and procedures to help you become a professional pilot. To accomplish this goal, you must attain the highest degree of proficiency possible. This requires initiative, good judgment, trained reflexes, and skillful flying, which come only as a result of study, practice, and determination. The information you learn here will form the foundation for your military aviation career. Good study habits are essential. Every detail is important if you expect to be a safe, professional pilot. Some important information from other publications is included in this manual, but in no way is this information considered all inclusive. The majority of the skills and techniques you develop in pilot training will come from your assigned instructor, from other instructors you fly with, and through your experiences. As you gain experience and confidence as a pilot, you will also develop your ability to use sound judgment. This manual and other publications are vital to flying operations. However, because of the many different situations you will encounter as a pilot, these publications can only provide a basis for good judgment. They do not replace it. The T-3 flight manual provides detailed instructions for inspections, checks, and procedures as well as valuable background information necessary to understand the aircraft systems. The T-3 flight manual and this manual complement each other.

1.2. Briefings:

1.2.1. **Preflight Briefing**. Missions throughout the Air Force are preceded by a preflight briefing. Your instructor, a designated supervisor, or the aircraft commander will place special attention on crew coordination concepts and transfer of aircraft control during emergency situations. Every individual flying the T-3 will be briefed on his or her specific duties and responsibilities related to safe mission accomplishment. Aircrews will refer to the briefing guides that incorporate the applicable items shown in attachment 2 and brief applicable items before each mission. Briefings should cover other important items of the flight as required. Solo students will not deviate from the briefed primary or alternate mission profile except as necessary during an emergency.

1.2.2. **Postflight Debriefing**. After each flight, your instructor will review the mission. This review should clear up mistakes you may have made, but ask questions if you failed to grasp all the concepts in any of the maneuvers. Becoming an Air Force pilot demands you fully understand each lesson. Be sure you understand your mistakes and how to correct them. The time to ask questions is immediately after the flight when your questions are still fresh in your mind.

1.3. Visual Inspection:

1.3.1. The preflight check starts before you reach the aircraft. Survey the taxi routes for any obstructions, such as repair work on or near the ramp, flight line equipment, or personnel who might be harmed by propeller blast. A complete visual inspection of the aircraft is a very important part of each mission. Use extra caution when approaching the aircraft. A moving propeller is sometimes difficult to see and, combined with noise in the ramp area, may give you the impression the propeller is not there or not moving. STAY CLEAR OF ALL PROPELLERS! Use caution for taxiing aircraft, fuel trucks, and maintenance vehicles when walking on the flight line.

1.3.2. Use a flight crew checklist, an abbreviated version of the flight manual, to ensure procedures are followed. Frequently refer to the checklist and ensure all items are completed. You don't have to refer to the checklist to complete each individual item. For example, complete a few items and then refer to the checklist to ensure you have completed all items properly. (Exception: It is not necessary to refer to the checklist during critical phases of flight.) Good checklist discipline is an integral part of military flying.

1.3.3. AFTO Form 781, **AFORM Aircrew/Mission Flight Data Document,** is the official log of aircraft operation, servicing, and maintenance. The importance of checking this form cannot be overemphasized. Report discrepancies, such as improper status or failure to sign off the preflight, to the line chief. Don't accept the aircraft until you are satisfied it is flyable. Definitions of the status symbols are inside the cover of the AFTO Form 781.

1.3.4. In addition to the AFTO Form 781, ensure all publications required by your mission (including local publications) are current and in the aircraft.

1.3.5. Carefully check for fluid leaks in the engine and wheel areas. These leaks are usually apparent from fluid along supply lines, seams, and line couplings. Check all fasteners closely. Note whether fasteners are flush, check the alignment of their slots, and tap panels with your hand to detect loose objects. Check the general condition of trim tabs, hinges, and control surfaces. Reject the aircraft if you notice binding of the controls or cracked hinges on control surfaces. Do not abruptly move the control surfaces. If you are not sure about the condition, setting, or operation of any single item, check with your instructor or qualified maintenance personnel. The pilot in command has final authority to accept or decline an aircraft.

1.3.6. Accomplish a postflight inspection of the aircraft following each sortie. The purpose of this inspection is to examine the general condition of the aircraft, not to accomplish any specific checklist. Look for any abnormalities requiring the attention of maintenance personnel, such as missing panels, damaged tires, or leaking fluids.

1.4. Position in the Aircraft. Each time you fly, your seat position in the aircraft should be the same. If you change your seat position on each flight, the landing picture will look different each time and you may have difficulty landing. Your instructor will help you determine the correct position. Prior to adjusting your seat belt and shoulder harness, ensure each of your rudder pedals are adjusted to the same setting and your seat cushions are positioned to allow free movement of the stick.

1.5. Before Starting and Starting the Engine Procedures:

1.5.1. The items in your checklist are listed in an order that begins from the left of the cockpit and moves to the right. This system makes it easy to learn and reduces the margin for error. As in the visual inspection, consider each item as important as the next. If you overlook an item, certain systems may become inoperative or damaged. Therefore, reference the checklist to ensure you complete and accomplish all items in the proper sequence. Part of the Before Starting Engines Checklist includes checking various cockpit instruments.

1.5.1.1. Check the vacuum gauge. It should not be indicating.

1.5.1.2. Ensure the airspeed indicator pointer is straight up.

1.5.1.3. Cage the main artificial horizon. The bank pointer should be aligned with the zero bank index. Ensure the warning flag is out of view. Set the miniature aircraft on the horizon with the pitch trim knob.

1.5.1.4. Check the altimeter is set field elevation. Ensure the 10,000, 1,000, and 100 feet pointers indicate the appropriate elevation.

1.5.1.5. Check the vertical speed indicator (VSI). It should read zero plus or minus 100 feet.

1.5.1.6. Check the magnetic compass. It should be full of fluid, the sphere upright, have no cracks and the heading accurate.

1.5.1.7. Check the directional gyro and the nav indicator for condition.

1.5.1.8. Check the directional turn and slip indicator. The race containing the ball should be full of fluid with no bubbles and the off flag should be out of view with power applied.

1.5.1.9. Check the clock. It should be running and the correct time set.

1.5.1.10. Unlike any other aircraft you will fly during your military career, you will probably not have a crew chief to assist you during engine start. Therefore, it is important to make sure the brakes have been properly set and to clear the area around the aircraft for personnel and obstructions. The canopy is closed and locked during the engine start. Stow loose articles in the cockpit before starting the engine or opening the canopy with the engine running. Before engaging the starter, clear the area around the aircraft a full 360 degrees and call “clear.” During engine start, closely monitor the engine instruments and ensure the brakes hold the aircraft in position.

1.6. Before Taxi and Taxi Procedures:

1.6.1. If a reliable VOR signal is available, you can check, tune, and identify the station. The off flag will then be out of view.

1.6.2. Check the suction gauge. It should be indicating.

1.6.3. Ensure the standby artificial horizon is erecting and adjust the miniature aircraft on the horizon with the pitch trim knob.

1.6.4. Set the directional gyro on the proper heading. During the taxi check, check the directional gyro, magnetic compass, and the turn and slip indicators for proper movement during turns.

1.6.5. Make sure the radio is on and the proper frequency is selected. Keep radio voice communications to a minimum at all times. A call to the controlling agency (for example, runway supervisory unit (RSU), ground control, or tower) serves as the radio check.

Remember, when you depress the transmit button, the entire channel is blocked for other aircraft. Do not depress the transmit button during another aircraft's transmission. If another aircraft is making a transmission, anticipate an answer to the radio call and do not break in. A general format for a professional radio communication is to broadcast who you are talking to, who you are, where you are, and what you want to do. It is imperative that your message be both clear and concise. Organize your thoughts, depress the transmit button, say what you intend to say, and get off the air. Do not transmit when another aircraft is in a critical phase of flight, such as in the flare.

1.6.6. Set the altimeter setting. The resultant indication should be within 75 feet of the published field elevation or designated altimeter checkpoint.

1.6.7. After the before-taxiing checks, visually clear to the front and rear. Make the appropriate radio call for clearance to taxi. Release the parking brake, increase power if necessary, and check wheel brakes for operation. Pick up momentum straight ahead, simultaneously apply rudder in the desired direction of turn, and reduce power (normally to idle). Avoid the tendency to neutralize the rudders just as the aircraft starts turning. This will merely straighten the nose wheel, necessitating the application of rudder to put the aircraft back in the turn. If you need a sharper turn, use a combination of differential braking and nosewheel steering to establish the angle of turn desired. If this becomes necessary, ensure the inside wheel is kept rolling. Any attempt to pivot the aircraft about a locked wheel is likely to damage the tire, wheel, or strut. To make sure the inside wheel rolls, intermittently release the brake. A small increase in engine power may be needed to offset the braking action. Apply the brakes smoothly, evenly, and cautiously at all times. When leaving a parking area, be especially alert for aircraft taxiing past your position. Also watch for personnel, ground equipment, etc. When on the ramp or in other congested areas, taxi at a walking speed.

1.6.8. When clear of the parking area, use power as needed to keep the aircraft rolling at a moderate speed. Nosewheel steering is more sensitive as you increase taxi speed. Use the brakes as sparingly as possible to prevent excessive wear and overheating. When using the brakes to slow or stop, ensure the throttle is in idle. While taxiing, do not perform checks until the aircraft is in an uncongested area. Most of your attention should be outside the cockpit.

1.6.9. Do not taxi aircraft with less than 10 feet wingtip clearance from an obstacle. Do not taxi without a wing walker when an obstacle is between 10 and 25 feet from the aircraft. This requirement is waived for locally based aircraft if established taxi lines are marked and obstructions are either permanent or other aircraft parked on established parking spots. Spacing between taxiing T-3As must be a minimum of two ship lengths.

1.6.10. The direction of the wind is an important consideration when taxiing. Although the aircraft is very stable on the ground with its wide wheel base, wing design, and nose-wheel steering, always be alert for the direction of the wind and use caution when taxiing into propeller wash or jet blast. As the wind strikes the side of the fuselage and rudder, the aircraft will have the tendency to turn into the wind. Nose-wheel steering is sufficient to maintain directional control in all but extreme crosswinds. In high or gusty wind conditions, proper use of the ailerons and elevator will help control the aircraft while taxiing. See figure 1.1 on how to properly position the flight controls while taxiing the aircraft.

1.7. Clearing:

1.7.1. When clearing, ensure your intended flightpath is

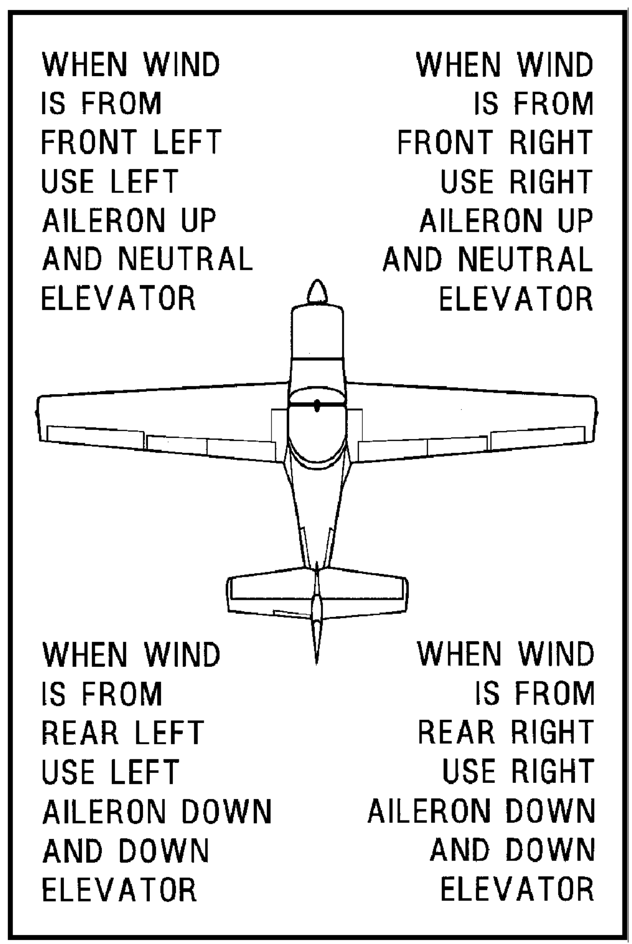

Figure 1.1. Taxiing in Wind.

well clear of other aircraft. How you clear depends on the maneuver, the configuration of the aircraft, and other flight planning factors. Be aware of the restrictions to visibility created by your position in the cockpit, such as the canopy bow, canopy rails, and the other pilot. Focus your eyes on a distant point and use various search patterns (vertical, horizontal, etc.). Use a definite pattern during your clearing instead of random looking. Constantly practice your search technique.

1.7.2. All aircrews operating in visual meteorological conditions (VMC) must maintain a constant vigilance for other aircraft. The use of radar monitoring or assigned areas does not relieve you of the responsibility to clear. Some maneuvers in the area are good clearing maneuvers; others may require a clearing turn or a whifferdill type of maneuver to adequately clear.

1.7.3. You can help yourself remain clear of local traffic by knowing areas of possible conflict. Be aware of the location of the departure and recovery routes, flying areas, and traffic patterns. Emphasize clearing in these directions. Listen for radio transmissions to help you track traffic in your vicinity. The more you know about your immediate flying environment, the better you will be able to detect and avoid other aircraft.

1.7.4. Area procedures and radio transmissions are only part of the overall effort to avoid other aircraft. The most important ingredient is your ability to visually detect each aircraft. Aircraft unfamiliar with the training areas and routing may fly through your airspace, so be alert.

1.8. Wake Turbulence. All aircraft generate wake turbulence, and the T-3 is very susceptible to wake turbulence. When you anticipate wake turbulence, proceed with extreme caution. Do not depend solely on a controller to advise you of the possibility of encountering wake turbulence. It is your responsibility in each case to ensure proper separation on final approach. Be especially aware of the possibility of wake turbulence during takeoff, approach, and landing. When you anticipate the possibility of wake turbulence, remain upwind or above the preceding aircraft's flightpath to keep you clear of that aircraft's wake turbulence. If you cannot remain above the aircraft's flightpath, consider increasing your spacing or going around. Use caution when going around from below the preceding aircraft's flightpath because you may fly through that aircraft's wake turbulence.

1.9. Transfer of Aircraft Control:

1.9.1. On the ground or during flight, there should be no doubt who has control of the aircraft. When you are in control of the aircraft, stay on the controls until told otherwise. During control transfer, the pilot relinquishing control will say "You have the aircraft." The pilot assuming control will say, "I have the aircraft," and will shake the stick noticeably. Both pilots must verbally acknowledge the transfer. Always relinquish the controls immediately on your instructors verbal command to avoid obstructing any flight control or throttle movement, especially during a critical phase of flight.

1.9.2. During unique situations, such as intercom failure or aircraft malfunction, your instructor will brief you on your responsibilities and how you will assist. Remember, if you are flying, stay on the controls until you know your instructor has control of the aircraft. If it is warranted and time and conditions permit, your instructor may give you verbal assistance.

1.9.3. At no time will two people be in control of the aircraft at the same time. This also applies to the brakes during engine runup for take off. Only the person in control of the aircraft will apply pressure to the brake pedals.

1.10. Student Responsibilities:

1.10.1. The purpose of the flight screening program is to lay a sound basis for further pilot training. Organizing and planning are major keys to fulfilling this objective. Your part of this process is to ensure you are properly prepared for the flight line, are well nourished, and have had adequate rest.

1.10.2. You must be prepared to fly when you report to the flight line. This means more than simply reading about the maneuvers in this manual. You should know all the procedures for a given maneuver and be able to state the sequence of actions. Many students find chair flying is a helpful technique in preparing for a mission. Basically, this involves organizing a mission profile and then simulating the flight, mentally reviewing each maneuver you must do. Another method is spending time in the cockpit. Your instructor will outline the procedures and policies for this training time. While in the aircraft, do not move any engine controls or switches. Remember, your time in the aircraft is limited. If you prepare properly on the ground, you will use your airborne time more profitably.

1.11. Flying Safety. Flying safety is more than merely a set of practices or a particular safety record; it is an attitude. You should continually evaluate your performance by asking, Did I perform that activity in a professional, disciplined, safe manner? Do this from the time you start planning a flight until you finish debriefing. One of the greatest hazards in flying is the potential for a midair collision. Your best defense is to see the other aircraft first. Aggressively clear the airspace around you, using the techniques your instructor will show you.

1.12. Ground Safety:

1.12.1. The flight line is a hub of activity. Consequently, this calls for extra attention on the part of everyone who is required to be there. You must constantly be alert for hazardous situations. Stay clear of all propellers. Never approach an aircraft from the front. Also use caution for propeller blast when walking behind aircraft with the engine running.

1.12.2. Thousands of dollars of damage occurs every year due to foreign object damage (FOD) on the flight line. Anything found on the runway or flight line that is not supposed to be there is considered FOD. A rock or even a piece of paper can damage a canopy or aircraft engine beyond repair. So every individual can help reduce FOD by picking up any FOD on the flight line and disposing of it.

Chapter 2

BASIC PRINCIPLES OF FLIGHT

2.1. Effects of the Controls. Each flight control affects the movement of the aircraft by controlling the movement about one of its three axes (figure 2.1). The lateral axis is an imaginary line which runs from wingtip to wingtip through the center of gravity perpendicular to the fuselage center line. The vertical axis is an imaginary line which runs through the center of gravity perpendicular to both the lateral axis and the fuselage center line. The longitudinal axis is an imaginary line which runs through the center of gravity parallel to the fuselage center line. The aircraft's center of gravity is at a point where its entire weight is theoretically concentrated. Only a shift in load will change the center of gravity. All three axes intersect at the center of gravity. All changes of aircraft attitude involve its rotation about one or more of these axes. You should learn these effects in order to control the aircraft and obtain the desired responses. Your instructor will demonstrate the use and effects of the controls, first in straight-and-level flight at cruising airspeed and then in

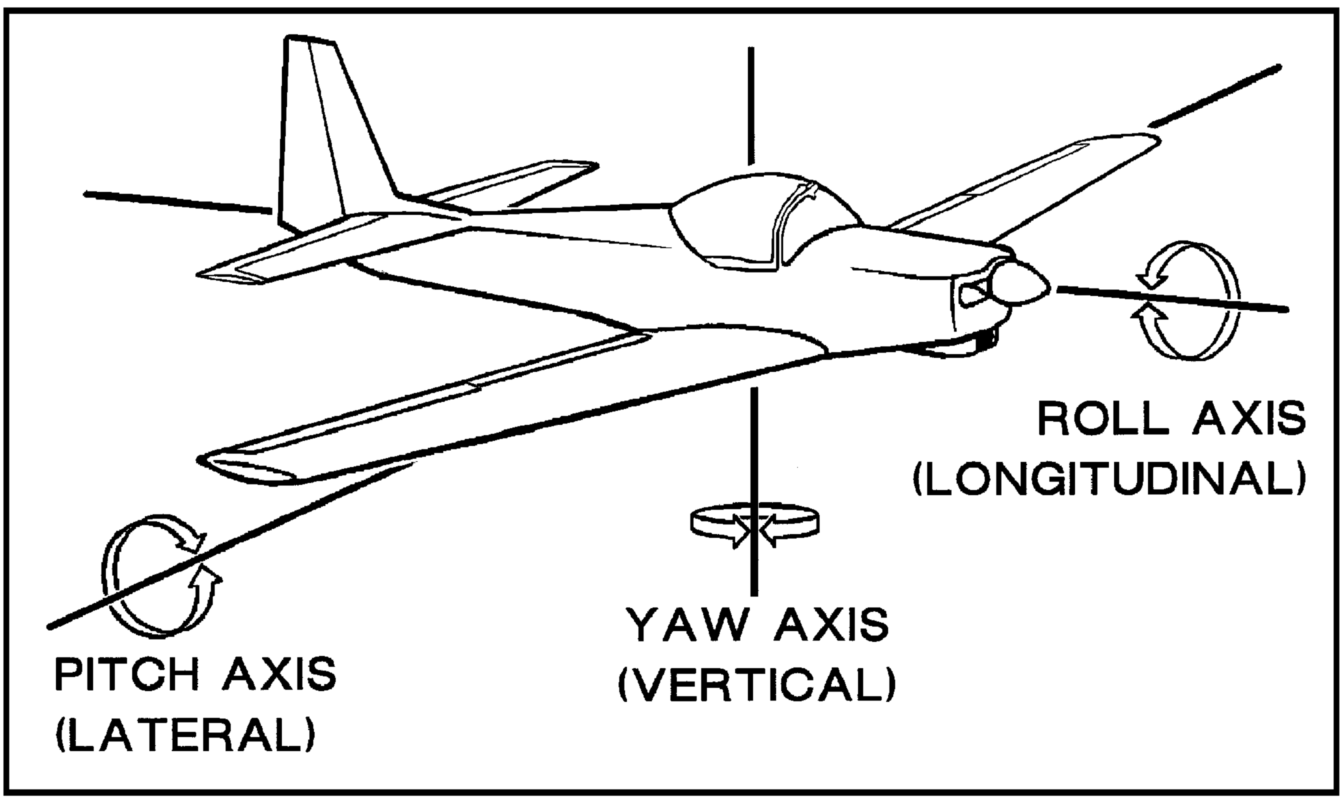

Figure 2.1. Axes of the Aircraft.

other flight attitudes. The same predictable responses to control movements will result regardless of the attitude of the aircraft. Think of yourself as the pivot point about which all changes of attitude occur.

2.1.1. **Pitch.** Moving the stick forward and backward (fore/aft) controls the aircraft's pitch (movement about the lateral axis). To achieve level, climbing, or descending flight, hold the nose of the aircraft in a fixed position relative to the horizon. You can use many other outside references to determine pitch attitudes, such as the position of the wingtips or the glare shield in relation to the horizon. You can also check the desired pitch attitude by reference to the flight instruments. Your instructor will show you the outside and instrument references for climbing and descending flight. Continuous cross-check of all pitch references will result in better control of the aircraft's pitch attitude.

2.1.2. **Yaw.** Yaw is movement about the vertical axis. When yaw exists, the ball in the turn-and-slip indicator displaces from center. Also, yaw causes your body to lean toward one side of the cockpit like rounding a corner in a car. Coordinated flight should be free of yaw even in a steep bank. When the aircraft is coordinated, your body retains a comfortable, upright position. The proper use of rudder is essential for coordinated flight.

2.1.3. **Roll**. Rotation about the longitudinal axis is caused by the lift differential created as aileron surfaces are moved out of the streamlined position of the wing. The wing with the raised aileron goes down because of decreased lift; the wing with the lowered aileron goes up because of increased lift. The effect of either aileron is augmented by the simultaneous and opposite movement of the aileron on the other wing. In level flight, moving the control stick toward a wing raises that wings aileron surface, causing the wing to go down and the aircraft to roll in that direction. Simultaneously, the other wings aileron goes down, causing the wing to go up.

2.2. Adverse Yaw:

2.2.1. The movement of the aileron surfaces out of the streamlined position creates drag. This drag is not distributed equally on each aileron; the down aileron (on the up wing) produces the greater drag. When this condition exists, the aircraft does not turn immediately in the desired direction, but tends to turn the opposite way. On the wing there is a difference in the curvature of the upper and lower surfaces. The bottom is fairly straight, but the top is distinctly curved. As Bernoullis theorem states, the difference in airflow speed over the surfaces must result in a difference in pressures and the higher static pressure area will be along the bottom surface.

2.2.2. When you use ailerons to bank an aircraft, the aileron that goes down extends into the area of greater static pressure, increasing drag. Due to the shape of the wing, the aileron that goes down also increases the positive camber of that wing, increasing both lift and induced drag. At the same time, the aileron that goes up on the opposite wing decreases the positive camber of that wing, reducing lift and induced drag. This combination of factors causes the aircraft to tend to yaw in the opposite direction while the banking action is taking place. This adverse yaw tendency continues until the ailerons are neutralized.

2.2.3. Adverse yaw is most apparent at low airspeeds and extreme control- surface deflections. At low or near-stalling speeds, adverse yaw is very noticeable. At high speeds, you may not notice it at all. This is because the movement required of the aileron surfaces is greater at lower speeds. You must move the ailerons farther from the streamlined position to cause an appreciable alteration of lift in the slower slip stream. The higher the angle of attack (AOA), the greater the pressure on the bottom side of the wing (until the stalling speed is reached and the airflow is disrupted). At high speeds a small airstream alteration generates more lift than in a slower airstream. Therefore, less aileron is needed to lift the wing.

2.2.4. Overcome adverse yaw by using the rudder. As you apply right or left aileron pressure, simultaneously apply rudder pressure on the same side. Use rudder pressure as long as the bank is changing. The correct amount of rudder pressure depends on the aircraft speed and the amount of aileron used. Keeping the ball centered in the turn-and-slip indicator is a guide to using the correct amount of rudder. Remember to use rudder and aileron pressure simultaneously, although the required amount of pressure will differ depending on the amount of aileron used, the airspeed, the effect of drag, and the design of the particular aircraft you are flying. Also remember that the aileron drag effect is present during recovery from a turn as well as during the entry. Use the rudder again in the same direction as aileron stick pressure to counteract adverse yaw.

2.3. Use of Controls. When a control surface is moved out of its streamlined position, the air flowing past it will exert pressure against the control surface and try to return it to the streamlined position. It is this pressure you feel on the stick and rudders. The airspeed and the degree the control surface is deflected determine the amount of pressure you feel on the controls. The higher the airspeed, the greater the pressure.

2.3.1. **How To Use the Rudder**. Position your feet comfortably with all the weight on your heels. Let your heels rest on the cockpit floor with the balls of your feet on the rudder pedals. When you use the rudder, apply pressure smoothly and evenly by pressing with your foot just as if you were using the brakes of an automobile. Don't let your legs and feet become tense; stay relaxed so you can feel rudder pressure.

2.3.2. **How To Use the Stick**. Generally, you should hold the stick lightly, the same way you would hold the steering wheel of an automobile--relaxed and comfortable. Some maneuvers, such as aerobatics, require more positive pressures. Let your arm and hands relax so you can feel the counter pressure from the stick, but always control the aircraft--never let it control you. Fore and aft movement of the control stick is transmitted to the elevator while lateral movement affects the ailerons. The weight of your right arm holding the stick may slightly displace the ailerons, which will result in flying with the right wing low. In most cases, this will cause a very slight turn to the right. To keep this from occurring, place the weight of your right arm on your thigh, reducing any tendency to move the stick to the right.

2.3.2.1. **The Elevator.** When the control stick is moved forward or backward, the elevator moves to a new position, effectively changing the camber or lifting properties of the control surface. The change in lifting force at the tail causes the aircraft to move to a different pitch angle which the pilot sees as a rotation about the lateral axis. A forward movement of the stick causes the aircraft nose to move downward as seen by the pilot. A backward movement of the stick causes the nose to move upwards. Note that these movements are relative to the pilots position in the cockpit and may not correspond to the aircraft's movements relative to the earth.

2.3.2.2. **The Ailerons.** The ailerons are located at the outer trailing edge of each wing. They are movable surfaces hinged to the rear of the wing and are actuated in unison by sideways movement of the control stick. Deflecting the ailerons alters the camber of the left and right wings differently, and the resulting imbalance in lift causes the aircraft to rotate about the longitudinal axis. Movement about the longitudinal axis is referred to as rotation in the rolling plane or banking the aircraft. Moving the stick towards the right will cause the right wing to lower which is referred to as rolling to the right or a right bank. The opposite motion causes a roll to the left or a left bank. A larger control stick movement will result in a more rapid rolling motion.

2.3.3. **How To Use the Throttle**. Move the throttle slowly at low revolutions per minute (rpm), increasing the rate of movement as the engine winds up. You can advance the throttle more rapidly at higher rpm. As a guide, move the throttle at a rate such that if throttle movement were stopped, rpm change would stop simultaneously. Learn to set the approximate desired power setting without staring at the tachometer or manifold pressure gauge. Do this by listening to the engine sound and noticing the relative throttle position. Cross-check the tachometer or manifold pressure gauge to refine the power setting. Avoid abrupt throttle movements unless absolutely necessary.

2.3.4. **Coordination**. We've discussed the effect of each control individually, but you should realize that no single control movement provides all the control for a maneuver. To fly your aircraft efficiently, you must use the controls together. This is known as coordination of controls and is vital to smooth flying. After you know how the aircraft will react when you move the controls, you must learn how to use them properly. Rough, erratic use of any of the controls causes the aircraft to react accordingly, so it is important you apply the pressures smoothly and evenly.

2.4. Composite Flight. Composite flight requires the use of outside references supported by flight instruments to establish and maintain desired flight attitudes. You will use composite flight throughout your flight training.

2.4.1. You will accomplish all maneuvers by establishing attitudes and progressively changing these attitudes throughout various stages of the maneuvers. Establish and maintain an attitude by positioning the nose and wings of the aircraft in relation to the horizon. You may not notice very small changes in attitude referencing the horizon, but the flight instruments will indicate the change. Be careful. Depending solely on your instruments has several disadvantages. The most serious one is the inability to observe aircraft and other hazards to flight while constantly monitoring your instruments.

2.4.2. You must have a good composite cross-check to ensure precise flying. Let the conditions dictate where you direct your attention. As the visibility deteriorates, increase the use of flight instruments. Develop your cross-check so all necessary information is obtained at a glance. Always maintain vigilance to avoid midair collision and to remain oriented. Do not concentrate on any one reference. You must maintain a constant vigilance for other aircraft. Check your reference, make a correction, look around, cross-check other references, and then return to the original reference, using all the references to confirm the accuracy of your control pressures or the need for a further correction. This process is continually repeated in composite flying.

2.5. Trim. When you consider all the factors which affect the aircraft in various conditions of flight, the need for trimming becomes apparent as airspeed changes. Considerable force is required to hold the correct elevator control pressure for level flight when airspeed changes. Flying would be very tiring if some means were not available to relieve these pressures.

2.5.1. Trim tabs act as levers to equalize the pressures exerted on either side of the parent control surface. To equalize pressures, move the trim tab in an opposite direction from the parent control (figure 2.2). The elevator trim tab is a small movable surface on the trailing edge of the left hand elevator which is used to equalize pressures on the top and bottom surfaces of the elevator. This tab keeps the elevator in the desired position, eliminating the need to maintain a constant control stick pressure. You can position the trim tab by operating an electrical trim switch located on top of the control stick. Pressing the switch forward with your thumb will cause a nose down trim input to relieve forward pressure on the stick. Pressing the switch aft will cause a nose up trim input. Your instructor will demonstrate the proper method of trimming the aircraft.

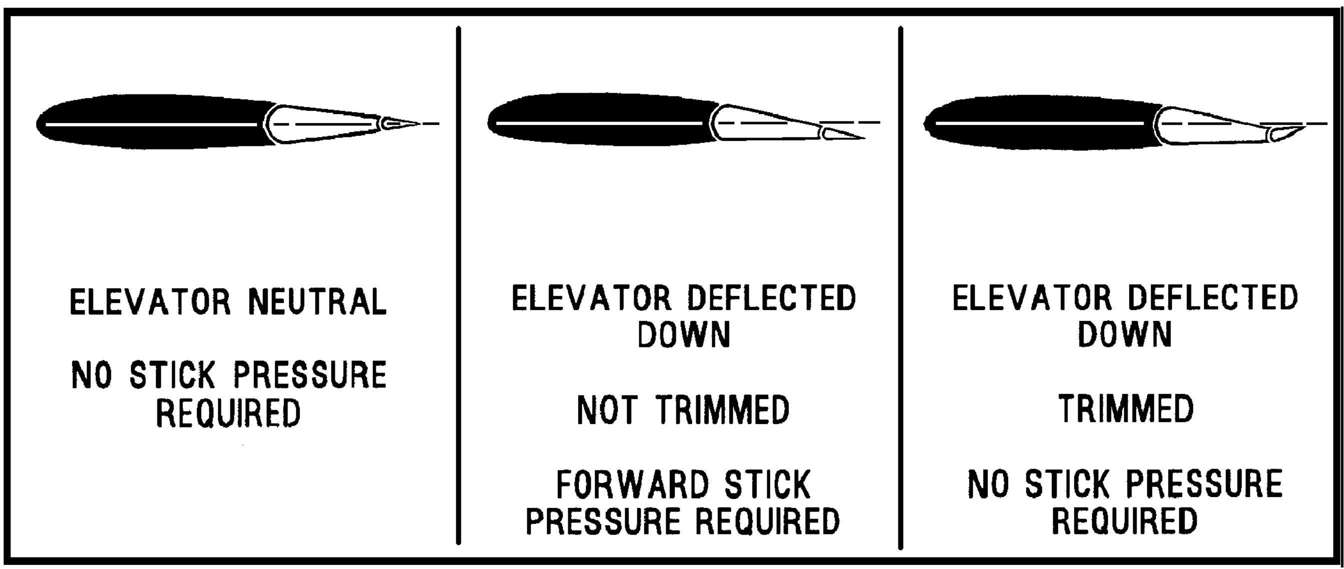

Figure 2.2. Trim Tabs--Aids to Smooth Flying.

2.5.2. In the T-3, power changes normally do not require large, immediate changes in control pressures. Therefore, the need for trim is evident only gradually as the airspeed changes. Always think of trimming as a recurring process.

2.5.3. As you extend or retract the flaps in flight, the camber of the wings airfoil changes, altering the lift and drag characteristics of the aircraft. The change in lift and drag results in a pitching motion about the lateral axis of the aircraft. If you want to maintain a constant flightpath while operating the flaps, you must also adjust the pitch attitude. Extending the flaps normally results in a pitch up; retracting the flaps results in a pitch down. You can compensate for the change in control pressures (fore or aft movement of the control stick) required to maintain a constant flightpath by using the trim.

2.6. Torque. Propeller torque is the aerodynamic resistance of a propeller to turning which tends to rotate the aircraft in the opposite direction to propeller rotation. Torque induced by the propeller of a single-engine aircraft also tends to lower the left wing and pull the nose of the aircraft to the left. There are several factors of torque affecting the aircraft during takeoff and in flight. The most prominent factors are asymmetrical loading and torque reaction. Actually, only the reaction force is torque in the strict sense of the word, but it has become common practice to group these forces together and call them the factors of torque. Although not directly attributed to torque, another factor induced by the rotation of the propeller is the slipstream effect.

2.6.1. **Asymmetrical Loading of the Propeller**. During level flight at cruising airspeed, the relative wind is approximately parallel to the longitudinal axis of the aircraft. In addition, the axis of rotation of the individual propeller blades will meet the airflow at the same angle and produce a similar lift or thrust force. As the AOA increases, the angle of the relative wind also increases and the angle the propeller axis of rotation makes with the airflow places the downward-moving blade at a higher AOA than the upward-moving blade. The greater bite of the downward-moving blade results in greater thrust and yaws the aircraft to the left. Therefore, in the T-3 the effect of asymmetrical loading becomes more pronounced as the AOA of the aircraft increases and (or) the airspeed decreases (figure 2.3).

2.6.2. **Torque Reaction**. For every action there is an equal and opposite reaction. Propeller torque is the aerodynamic resistance of the propeller to rotation. This resistance tends to rotate a single-engine propeller-driven aircraft in the opposite direction of propeller rotation. As viewed from the cockpit, the propeller on the T-3 rotates clockwise which tends to roll the aircraft counterclockwise or to the left. This tendency is more pronounced as power increases.

2.6.3. **Slipstream Effect.** The high speed rotation of the propeller gives a corkscrew motion to the slipstream (figure 2.4). Due to the clockwise rotation of the propeller, the slipstream strikes the vertical fin and the rudder slightly from the left, causing the nose of the aircraft to yaw to the left. The rudder is equipped with a small, ground adjustable trim tab set to trim off the rudder forces at cruise rpm and airspeed. When operating at high power settings and (or) low airspeeds, the trim tab is not effective, so you must apply right rudder to eliminate yaw. During low power or high airspeed situations, the trim tab is overly effective and you must use left rudder to eliminate yaw.

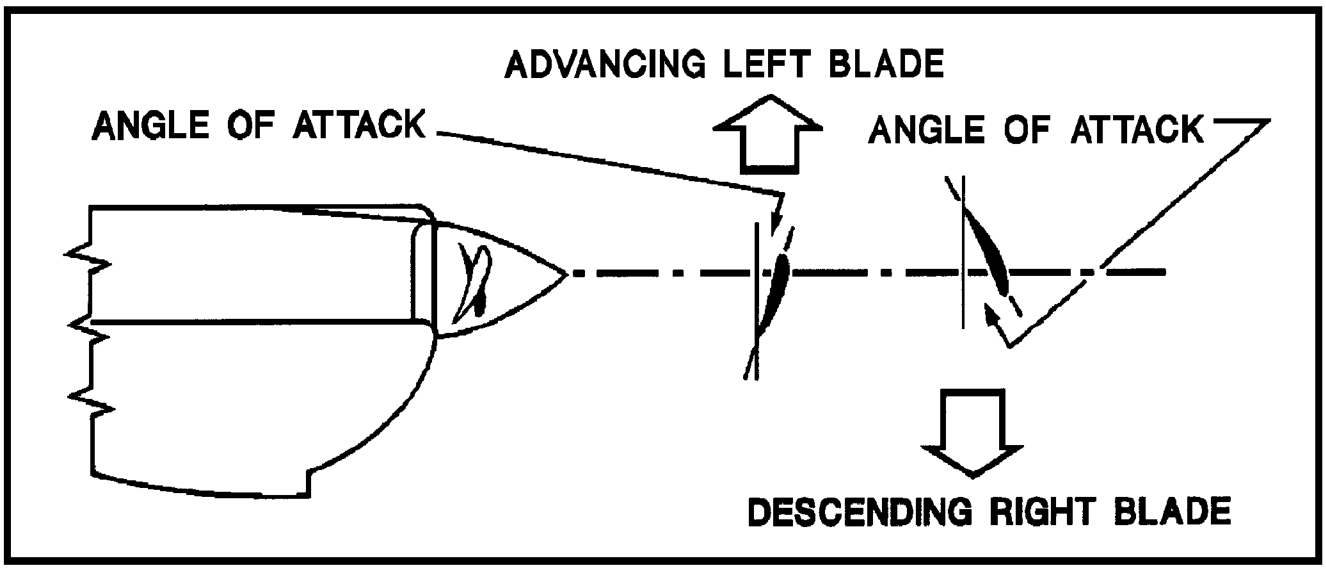

Figure 2.3. Asymmetrical Loading of the Propeller.

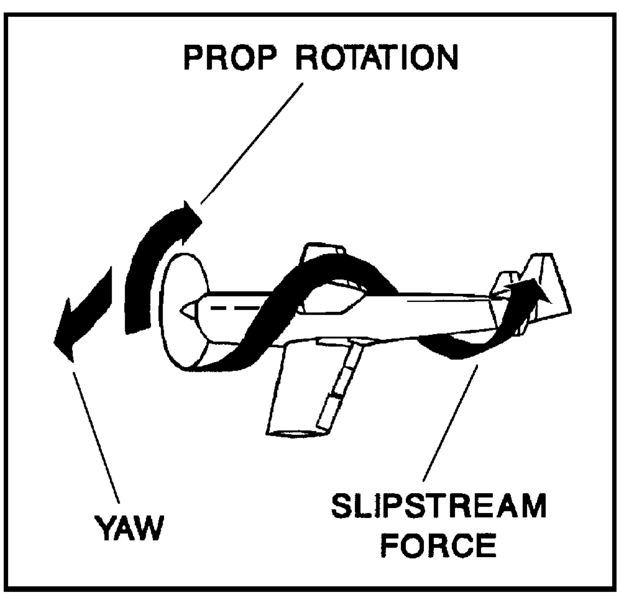

Figure 2.4. Slipstream Effect.

2.7. Straight-and-Level Flight. This training exercise teaches you how to use the flight controls, combine the use of outside and instrument references for maintaining aircraft attitude, and learn to divide your attention by constantly checking all available references without concentrating on any one reference.

2.7.1. **Flight Instruments**. Before practicing straight-and-level flight, you must be familiar with the flight instruments. You must understand the effect and use of the controls and be relaxed and properly seated in the aircraft.

2.7.1.1. The approximate power setting for normal cruise straight-and-level flight is dependent on cruise altitude and desired cruise speed. Attaining level flight is a matter of consciously fixing reference points on the aircraft in relation to the horizon and comparing or cross-checking this relationship with the flight instruments. The instruments you refer to for control of pitch attitude are the attitude indicator, altimeter, vertical speed indicator (VSI), and airspeed indicator.

2.7.1.2. Your instructor will show you each instruments indication in conjunction with outside references. Do not concentrate too much on one reference or stare at a particular reference. This will not only hinder your progress, but will create a dangerous situation because you will not be clearing for other aircraft. Check each outside and inside reference in turn, and use each for minor control adjustments. You must have a thorough knowledge of the design, location, and information presented by all instruments. Familiarity with these instruments and outside references enables you to determine the control pressures necessary to control the attitude and the direction of the aircraft. Control pressures should be smooth and applied with confidence. The beginning student often overcontrols from lack of experience, but this tendency can be minimized through practice of smooth application. Good control is a continuous succession of minor, almost imperceptible corrections to keep the aircraft in the desired flightpath.

2.7.2. **Establishing the Correct Level Flight Attitude.** After you have had a little practice in straight-and-level flight and have learned to check all your references properly, you can establish the correct level flight attitude in a few seconds. You will learn to look around quickly and establish pitch, bank, and direction simultaneously. Power changes and trim technique will become second nature. Remember to trim the aircraft when you find yourself holding continuous stick pressure to maintain the desired flightpath.

2.7.2.1. A common student error is the tendency to stare at the nose of the aircraft and attempt to hold the wings level just by observing the windscreen in relation to the horizon. This will not work, particularly in the T-3 which has a rounded glare shield. It may result in flying with one wing low. This wing-low attitude requires the use of additional rudder to maintain straight flight and gives a false perception of neutral control pressures as well as an uncomfortable seat position. This is another reason why it is important to continuously cross-check all references.

2.7.2.2. Let your eyes sweep along the horizon, picking up the wingtips, and make a mental note of required corrections. At the same time, look for other aircraft that might be flying in your area. Make your corrections and return to inside references to confirm them. Then look outside again in a continuous process. Soon it will become second nature and effortless.

2.7.2.3. Straight-and-level flight requires almost no pressure on the controls if the aircraft is properly trimmed and the air is smooth. When you are flying through turbulence, the flight attitude may change abruptly. Do not fight the controls to stop these changes. Ride them out like a boat on a rough sea, making smooth but firm adjustments as needed.

2.8. Turns. Use a turn to change the direction of the aircraft. Turning involves the close coordination of all three controls; ailerons, rudder, and elevator. Since turns are incorporated in almost all aircraft maneuvers, it is important that you learn to perform them well. The shallow bank turn is a turn of approximately 30° of bank or less. The medium bank turn is between 30° and 45° of bank. The steep turn is a turn with 45° to 60° of bank.

2.8.1. Before beginning any turn, look in the direction of the turn to clear above, below, and at your flight level. Do this to make sure the area is clear of other aircraft. Once you have cleared the area, simultaneously apply pressure to both ailerons and rudder in the direction of the turn. This pressure will move the control surfaces out of their streamlined position and cause the aircraft to bank and turn. The rate at which the aircraft rolls is governed by the amount of pressure applied and the airspeed. Hold the pressures constant until you obtain the desired angle of bank. In establishing this bank attitude, use both outside and instrument references.

2.8.2. As the aircraft begins to roll, a point on the windscreen directly in front of you will appear to pivot on the horizon. This imaginary level flight reference point should remain on or near the horizon throughout the turn to maintain level flight (figure 2.5). As the bank increases, the pitch attitude will have to increase to compensate for the loss of vertical lift. In shallow turns, the increase in pitch attitude is relatively slight. As bank increases, the required increase in pitch attitude is more pronounced. Also, in steep turns you need to increase power to maintain airspeed.

2.8.3. Just like straight-and-level flight, you can use several outside references. The best outside reference for the degree of bank is the angle of the horizon across the windscreen. As you approach the desired angle of bank, return the ailerons and rudder to neutral. This stops the bank from increasing. Maintain elevator pressure to maintain a constant pitch attitude. Throughout the turn, hold the angle of bank constant with adjustments of the ailerons.

2.8.4. To correct an excessive nose-low attitude in a

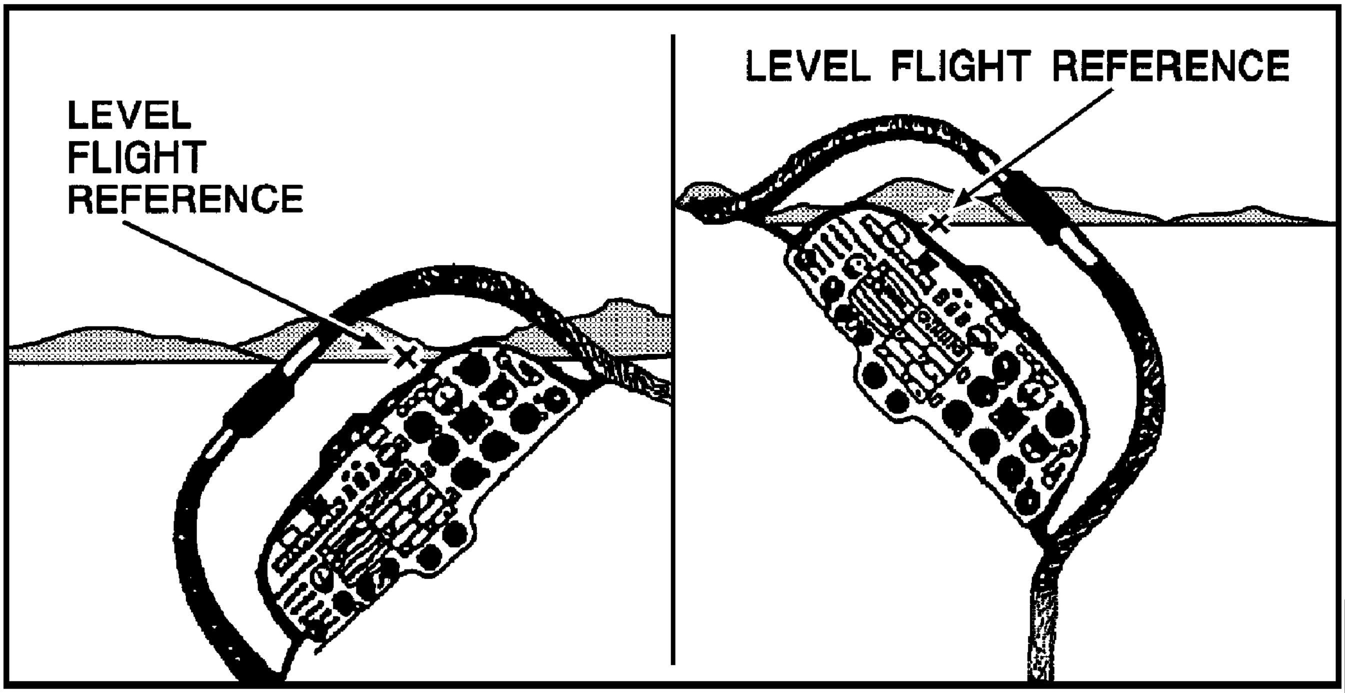

Figure 2.5. Left and Right Turn References--45° Bank Angle.

steep turn, reduce the angle of bank with coordinated aileron and rudder pressure. Simultaneously use back pressure to raise the nose to the desired pitch attitude. After doing this, reestablish the desired angle of bank. Do not try to make corrections with just one of the three controls--use them all together.

2.8.5. The rollout from a turn is much the same as the entry except you use opposite control pressures. Apply aileron and rudder pressure in the direction of the rollout (toward the high wing). As the angle of bank decreases, release the elevator pressure smoothly to maintain altitude. With decreasing angle of bank, the effects of centrifugal force and the loss of vertical lift are reduced.

2.8.6. Because the aircraft normally will turn as long as there is any bank, start the rollout before reaching your desired heading. The aircraft will turn some during the time it takes to level the wings. The steeper the bank, the more lead required to roll out on a desired heading. Release the pressures smoothly until neutralizing the controls as the wings become level. Your posture in the aircraft is very important to all maneuvers. Do not lean forward, backward, or side to side. Instead, sit erect and move your head around freely (figure 2.6). During turns, maintain this position. Do not lean away from the turn or attempt to keep your body vertical with the horizon. Relax and ride with the turn. If you do not maintain a constant position in the cockpit, your outside references continually change. Relaxed pilots are usually good pilots because they are free to think and can feel the pressures

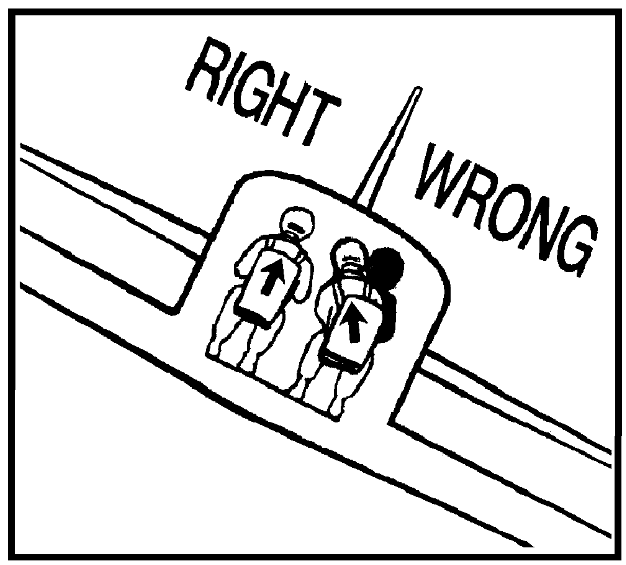

Figure 2.6. Posture in a Turn.

on the controls.

2.8.7. Plan all your turn exercises so you make precise turns, using a constant angle of bank and a definite amount of turn. To make a precision 90° turn, align the aircraft with a road or section line on the ground and turn perpendicular to it. In the absence of any ground reference, pick a point on the horizon that is directly off a wingtip; then turn to that point. Remember to clear the area prior to and during the turn.

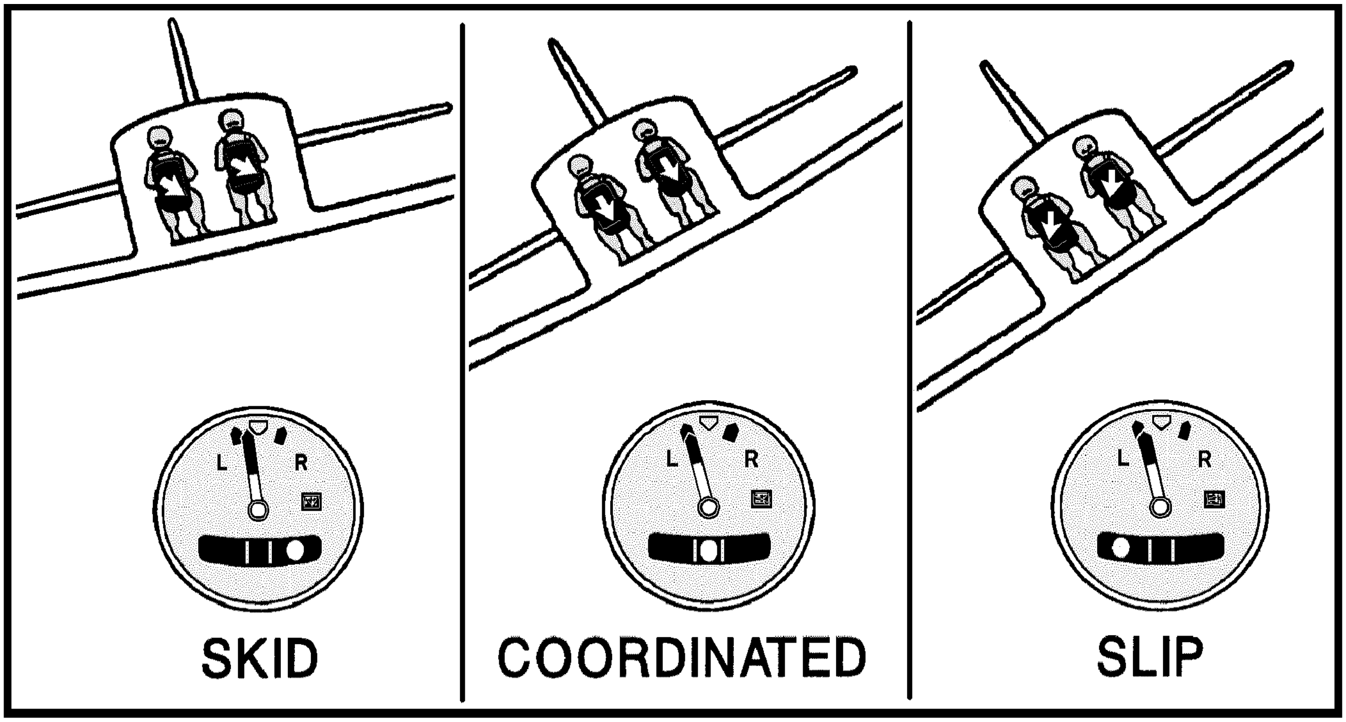

Figure 2.7. Skid and Slip During a Turn.

2.8.8. A common misconception among students is that a steep turn is entirely different from a shallow turn. This mistaken idea probably comes from the fact that all of the aerodynamics of a turn are more prominent in a steep turn. Basically, the difference between steep turns and other turns is the amount of back-stick pressure and power needed to maintain level flight. A common error is the misuse of controls when entering a steep turn. Some students apply prematurely. This is sometimes caused by the natural tendency of the arm to move backwards as it moves to the side. Steep turns are easy to perform if you roll into them like you roll into shallow turns. But remember to anticipate the need for additional back pressure and power as the angle of bank increases.

2.8.9. **Steep turns**. Steep turns as a maneuver are flown using approximately 60° of bank in a turn of 360°. To complete the maneuver, perform one to the left and one to the right.

2.9. Uncoordinated Flight. In a coordinated level turn with constant bank and airspeed, the flightpath of the aircraft is a true circle if the wind is calm. Otherwise, the flightpath is not necessarily a true circle over the ground because of drift. Uncoordinated control, erratic bank, or changes in airspeed will cause variations in the circular flightpath. Referencing the ball in the turn-and-slip indicator is one technique to determine if you are flying in a skid or slip.

2.9.1. **Skid.** A skid is caused by insufficient bank angle in relation to the turn rate of the aircraft (figure 2.7). This occurs if you use too much bottom rudder pressure in relation to the aileron pressure or if any bottom rudder is held after establishing a turn. A skid also occurs in level flight if the nose of the aircraft rotates sideways about the vertical axis when the wings are held level, resulting in a slow turn. This occurs when rudder pressure is inadvertently held or the aircraft is improperly trimmed. In a skid, the turn needle and ball are deflected in opposite directions.

2.9.2. **Slip**. A slip is caused by too much bank angle in relation to the turn rate of the aircraft (figure 2.7). When establishing a turn, if you use insufficient bottom rudder pressure in relation to the aileron pressure, a slip will result. You can also slip the aircraft by holding the opposite rudder in a turn. In a slip, the turn needle and ball are deflected in the same direction.

2.10. Area Orientation. You are required to carry a copy of your local in- flight guide and a map of the local flying area on all flights. Use your map and landmarks as primary references for departure, recovery, and area orientation. Additionally, use the aircraft's navigation equipment as a backup in case of restricted visibility or unfamiliar area assignment.

Chapter 3

EMERGENCY PROCEDURES

NOTE: The emergency procedures in this chapter supplement those in the T-3 flight manual. The importance of studying all emergency procedures cannot be overemphasized.

3.1. Complete Electrical Failure. If you encounter complete electrical failure (of the alternator and battery), fly over the RSU or tower (as applicable) at an altitude of 500 feet above the ground (AGL) and at an airspeed of 120 knots. This will alert the controller to your situation.

3.1.1. At the end of the runway, make a 180° climbing turn to the downwind leg. Roll out at normal pattern altitude. With complete electrical failure, you will configure normally for landing because the flaps are not affected. However, you will have to use the manual trim system. Because the radio and navigation lights are inoperative, clearing becomes even more important.

3.1.2. Be alert for a red light or flare from the RSU or tower. This may be a warning of some unseen hazard. If you receive a steady green light or no light from the RSU or tower and it appears a safe landing is possible, continue with the approach and landing.

3.1.3. In certain situations, you may fly the electrical failure pattern when you do not have radio contact with the RSU or tower and want to declare an emergency. Depending on your problem, you may continue with an overhead pattern or perform a straight-in approach.

3.2. Radio Failure. When the RSU is in control of the runway, fly a normal overhead pattern, rocking the wings on initial. Watch for a green light from the RSU. If no light is received, flash the taxi light on final and continue the pattern. Do not sacrifice aircraft control to flash the light. When the RSU is not in control of the runway, fly the aircraft alongside the landing runway while rocking the wings. Turn to downwind at the end of the runway and check the tower or RSU for a green light on base leg and final approach. If you experience radio failure while under radar control, squawk mode 3, code 7600 in your transponder.

3.3. Airspeed Indicator Malfunction. An interruption of static or impact pressure will cause an airspeed indicator malfunction. An obstruction at the static ports or pitot tube will cause erroneous cockpit indications. This may result in a slow decrease toward zero, a static indication, or possibly an erratic indication. You should suspect a malfunction if you note any improper response. It is important to remember to turn on the pitot heat when flying in visible moisture to prevent the formation of ice.

3.3.1. The corrective action taken for pitot static system malfunctions may vary, based on the situation. Because the aircraft is equipped with an emergency static vent, operation of the vent may correct the problem. However, be sure to cross-check all the pitot-static instruments; do not immediately assume all the instrument indications are accurate. The only cockpit correction for pitot-tube blockage is to use pitot heat.

3.3.2. Recovery and landing with an airspeed indicator inoperative may vary. Although you should consider your proficiency and familiarity with the different patterns and flap configurations, the preferred method of recovery is by flying a straight-in approach. Use caution during flight without an airspeed indicator. You must use approximate power settings and pitch attitudes to maintain the desired airspeeds. Avoid rapid pitch and power changes and initiate immediate recovery procedures for any stall indications.

3.4. After Landing With an Emergency. If you require assistance from fire protection or maintenance personnel during an emergency landing, hold the brakes and raise both hands to signal it is clear to inspect the aircraft. Do not actuate switches without visual coordination with the ground crew.

3.5. Lost Procedures. If you do not pay attention to where you are flying, you may become lost or disoriented. You should have a map of the area to keep yourself oriented in relation to known landmarks at all times. If you should become lost, do not hesitate to call for assistance. It is far better to admit you are lost and get help than to wander aimlessly until you are low on fuel and have to force land.

3.5.1. Based on normal syllabus missions, fuel consumption should not be a factor. However, you should take immediate steps to conserve your remaining fuel. While calling for assistance and trying to determine your position, climb to the optimum altitude as indicated in the Cruise Performance Data and establish the maximum endurance airspeed appropriate for your flying area and conditions. The charts use true airspeed (TAS). Your local area procedures may dictate altitudes and indicated airspeeds to fly at your location. As a rule of thumb you can subtract 3 knots for every thousand feet above sea level to calculate the desired indicated airspeed. For example, at 10,000 feet MSL, 103 KTAS equals 73 KIAS.

3.5.2. Attempt to contact an air traffic control radar facility (or the agency specified in local area procedures) on the radio. If there is no contact, channelize the radio to other frequencies listed in your inflight guide. Squawk mode C (Alt) and code 7700 on your transponder. If you cannot contact a radar facility on the listed frequencies, attempt contact on Guard, (121.5) VHF or 243.0 (UHF). Preface your calls with, Mayday, Mayday, Mayday, and give your call sign and type of emergency. Several controlling agencies will probably answer your distress call. Select one agency and tell the rest to remain silent. The agency you select will attempt to identify you by requesting that you change your transponder code. Once you are identified, you will be given directional information to the nearest suitable airfield or, if sufficient fuel exists, to your home field. Remember, the ultra high frequency (UHF) or very high frequency (VHF) radio works on a line-of-sight transmission principle. The higher your altitude, the more likely you will maintain radio contact with a ground facility.

3.5.3. If you decide to accept radar vectors or attempt to home to a VOR station, ensure your directional gyro is operating properly. Check it with the magnetic compass. If these instruments do not agree, reset the directional gyro to agree with the magnetic compass. If you notice excessive precession in the directional gyro, disregard it and use the magnetic compass. If you decide to home to a station, use the following procedures:

3.5.3.1. Tune and identify the VOR station. This is accomplished by first checking that the desired frequency is dialed in and displayed as the active frequency in use on the communications/navigation (COM/NAV) panel. To identify the station, push in the appropriate headphone push-button on the audio control panel and pull out the PULL IDENT knob on the COM/NAV panel. Ensure you can to hear an oral or Morse Code station identifier.

3.5.3.2. Rotate the omnibearing selector (OBS) selector knob on the VOR/localizer indicator to center the deviation bar with a TO indication in the TO/FROM window. Observe the course shown at the top of the instrument. This is the magnetic bearing from the aircraft to the VOR station. Fly this heading until the deviation bar moves off the center of the instrument.

3.5.3.3. Continue to center the deviation bar as necessary to fly the aircraft to the VOR station. This procedure is called homing to the station. Because homing does not incorporate wind drift correction, in a crosswind the aircraft follows a curved path to the station. As the aircraft approaches the VOR station, the deviation bar may move from side to side and the TO/FROM indicator may fluctuate between TO and FROM. You have definitely flown past the station when you receive the first steady change from TO to FROM. Once past the station, turn to a heading that will take you to the airport by referencing the lost procedures for your local area.

3.5.4. If you can not establish radio contact with any controlling agency, try to determine your position by radial and distance measuring equipment (DME) from a known navigational facility. If the DME is inoperative, try to orient yourself by using two VOR stations. Tune in a nearby VOR and note the radial you are on. Draw this line from the VOR on your map. Tune in another nearby VOR and note the radial you are on. Draw this line from the second VOR on your map. The point where the two radials cross is your position within 2 or 3 miles. Factors such as inaccurate plotting and movement of the aircraft affect the accuracy of the fix. However, in the absence of other landmarks, this two- bearing fix is very useful.

3.5.5. If you can’t establish your position or navigate by using aircraft instruments, pick out some outstanding landmark on the ground. A significant body of water, a town, or a railroad crossing are all good landmarks. Try to find your selected landmark on your local area map. You should have some idea of your general location so look for your landmark in that general area on your map. Orient your map with the aircraft heading.

3.5.6. If you cannot locate the landmark on your map, don’t just wander around aimlessly. Fly a definite heading until you can pick up another good landmark. Set up an orbit around it and identify it.

3.5.7. If you still cannot locate your position, look for a suitable airstrip or field and land before you run out of fuel.

Chapter 4

TAKEOFF, CLIMB, AND LEVEL OFF

4.1. Pretakeoff. You must prepare yourself and your aircraft for the takeoff. Make absolutely certain you have completed all applicable procedures and checklist items. (See attachment 3 of this manual for the solo turnaround checklist.) When cleared for takeoff, acknowledge your clearance by giving your call sign. Before taxiing onto the runway, ensure you close and lock the canopy. Look around to make sure both the runway and final approach are clear. Taxi onto the runway, ensuring the nose wheel is aligned straight down the runway.

4.2. Takeoff Options. Normally after receiving your takeoff clearance, you will taxi onto the runway, smoothly apply full power, and begin the takeoff roll. However, under certain conditions you may be cleared to taxi into position and hold. This means you may taxi onto the runway, but are not cleared for takeoff. Be sure to acknowledge this restricted clearance (CALL SIGN, on to hold). Then line up in the center of the runway, stop, and wait for clearance to takeoff before you begin the takeoff roll.

4.3. Takeoff:

4.3.1. **Takeoff Roll**. You should be ready to begin the takeoff roll as soon as you have the aircraft aligned with the runway center line. Normally, you don't need to bring the aircraft to a standstill before applying full power. Ensure your feet are on the bottom of the rudder pedals and your heels are on the floor, not on the brakes. Smoothly apply full power, hold the control stick just aft of neutral, and position the controls for existing wind conditions. Maintain directional control with smooth rudder application (anticipate the use of right rudder to counter the effect of torque) and look down the runway at the horizon. You must check the engine instruments early in the takeoff run to confirm the engine is developing full power and no malfunctions exist. You will feel the elevator gradually become effective as the airspeed increases. At this point in the taxi-flight transition, the aircraft is flying more than taxiing. As this occurs, you need to make progressively smaller rudder corrections. At approximately 40 to 45 KIAS, the nosewheel should leave the ground. Use stick forces as necessary to establish the takeoff attitude. Hold this attitude and the aircraft should leave the ground at approximately 53 KIAS with 18° of flaps and 58 KIAS without flaps. At high density altitudes takeoff speeds are increased. The first portion of the takeoff roll and nosewheel liftoff are the same as described above; however, the main wheels will not normally leave the ground until 65 KIAS for 18° flaps and 70 KIAS for 0° flaps. The flight manual contains further discussion on high density altitude operations. Because a good takeoff depends on takeoff attitude, it is important to know how to attain this attitude. The ideal takeoff requires minimum pitch adjustment after the aircraft becomes airborne. Your instructor will demonstrate the takeoff attitude. Use back pressure as necessary to hold this attitude. Keep the wings level by applying aileron pressure. At the takeoff point, all flight controls are effective in maneuvering the aircraft. At any time during the takeoff a situation may arise that requires an abort. The decision to abort depends on the nature of the problem, speed, and runway remaining. You must make decisions accurately and quickly. With certain types of malfunctions, you may find it advisable to continue the takeoff and then land as soon as practical. In any event, use flight manual procedures and limitations to help you make your decision to abort or continue the takeoff. Your instructor will help you develop the judgment to make accurate, timely decisions. There is no substitute for good judgment.

4.3.2. **Leaving the Ground**. Maintain the takeoff attitude. As the aircraft leaves the ground, maintain the correct flight attitude and direction. If you hold insufficient back pressure, the aircraft may settle back to the runway after the initial liftoff. However, be careful not to force the aircraft into the air by applying too much back pressure before gaining adequate flying speed. If this happens, the nose may rise so high that a stall develops. Forcing the aircraft into the air prematurely is an unsafe practice and must be avoided.

4.3.3. **After Becoming Airborne**. The aircraft accelerates rapidly after becoming airborne. Maintain directional control by using the ailerons to keep the wings level and rudder to eliminate yaw. Raise the flaps (if applicable) after you have obtained a minimum of 80 KIAS. Maintain a shallow climb and allow the aircraft to accelerate to the proper climb speed of 90 KIAS or as locally directed. As the aircraft accelerates, use trim as required to relieve control stick pressures. If no elevator or trim corrections are made during departure, the increased control effectiveness at higher airspeeds will cause a steeper-than-desired climb out. If a crosswind is present, use the ailerons as required to initiate a shallow turn into the wind to eliminate drift. Select a distant reference point aligned with the runway and use it to make sure you are not drifting. In addition, check your runway alignment by looking behind the aircraft. If your drift correction is proper, the aircraft will maintain a straight path over the ground away from the runway.

4.3.3.1. If an aircraft takes off immediately ahead of you, anticipate the possibility of wake turbulence, especially if the wind is calm or straight down the runway. Although sudden deviations in flight attitudes may occur, do not become alarmed. Use firm control pressures to make a very shallow turn in either direction to fly out of the wake turbulence. Then realign the aircraft with the original flightpath. If a crosswind is present, make the turn upwind so the wake turbulence will drift away from your flightpath.

4.4. Crosswind on Takeoff:

4.4.1. **Takeoff Roll (Crosswind).** As you taxi into takeoff position, check the windsock or other wind indicators or get wind data over the radio so you can anticipate the crosswind.

4.4.1.1. The initial takeoff roll technique for a crosswind is the same as for a normal takeoff except you need to hold the aileron into the wind as you start the takeoff roll. You will also need to apply opposite rudder to keep the aircraft from weathervaning (that is, streamlining itself into the wind). Keep in mind the effects of torque and rudder usage during normal takeoffs. When crosswinds are strong approaching the maximum allowable wind limits, delay rotation until reaching takeoff speed.

4.4.1.2. As the aircraft approaches flying speed, the ailerons become more effective. You will gradually reduce aileron deflection to keep the wings level, but you have to maintain some aileron deflection throughout the takeoff roll. This aileron deflection is necessary because the upwind wing develops more lift, causing it to fly (begin rising) before the downwind wing.

4.4.1.3. If the upwind wing rises and exposes more impact surface, a skipping action may result. This is a series of very small bounces caused by the aircraft's attempting to fly on one wing and then settling back onto the runway. During these bounces, the crosswind will move the aircraft sideways and the bounces will develop into side skipping. This skipping imposes stress on the landing gear, which could result in materiel failure. In addition, the aircraft will tend to weathervane more.

4.4.1.4. During takeoffs in gusty wind conditions, be alert for rapidly changing wind direction and velocity. Make timely corrections to maintain directional control during the takeoff roll.

4.4.2. **Leaving the Ground (Crosswind)**. As the wheels leave the runway, the aircraft will start drifting with the wind. Relax the rudder pressure, and turn the aircraft into the wind until an adequate crab is established. Then neutralize the crosswind aileron. Continue to crab during the climb to maintain runway alignment on the takeoff leg (figure 4.1). The remainder of the takeoff climb is the same as explained in paragraph 4.3.3.

4.5. Climb and Level Off:

4.5.1. **Turns After Takeoff and Traffic Exit.** After takeoff, climb straight ahead to a minimum altitude of 400 feet AGL or to the altitude specified in the local procedures manual. When past the departure end of the runway and clear of all aircraft, turn in the direction of traffic using the bank angles required in local directives. This turn constitutes the exit from the traffic pattern unless the local airport pattern dictates otherwise.

4.5.2. **Climbs**. A normal climb is a maneuver executed to gain altitude in a safe and orderly manner. The procedures for straight climbs and climbing turns are the same except that for climbing turns, you use a shallow bank and modify your composite cross-check to monitor your flightpath and aircraft performance. Trim is an important consideration during a climb. When you have established the climbing attitude, trim the aircraft to relieve all pressures from the controls. When you adjust the flight attitude and (or) airspeed, retrim the aircraft.

4.5.3. **Straight-Ahead Climbs**. To establish a straight climb from level flight, raise the nose to a climbing attitude and smoothly advance the throttle to full power. Use outside references when making all pitch changes or maintaining a wings-level attitude. An occasional glance at the attitude indicator will help. Use section lines or other outside references supported by the heading indicator to maintain straight flight. Your instructor will show you the climbing attitude at different altitudes and the outside references to maintain the attitude. If the wingtips are an equal distance from the horizon, the attitude indicator should show a wings-level attitude. As you establish the climb, use back pressure to increase the pitch attitude. When the airspeed decreases to the desired reading, the amount of backstick pressure required to hold the airspeed will become constant. Use elevator trim to neutralize the stick pressure. A slight amount of rudder pressure may be required to coordinate flight. Once this is done, you can maintain an attitude without holding pressure on the stick.

4.5.4. **Climbing Turns**. During turns, the loss of vertical lift becomes greater as the angle of bank increases, so use shallow- banked turns to maintain a good rate of climb. During the early part of your training, make each turn a separate maneuver, pausing momentarily before establishing another turn. This will give you practice in

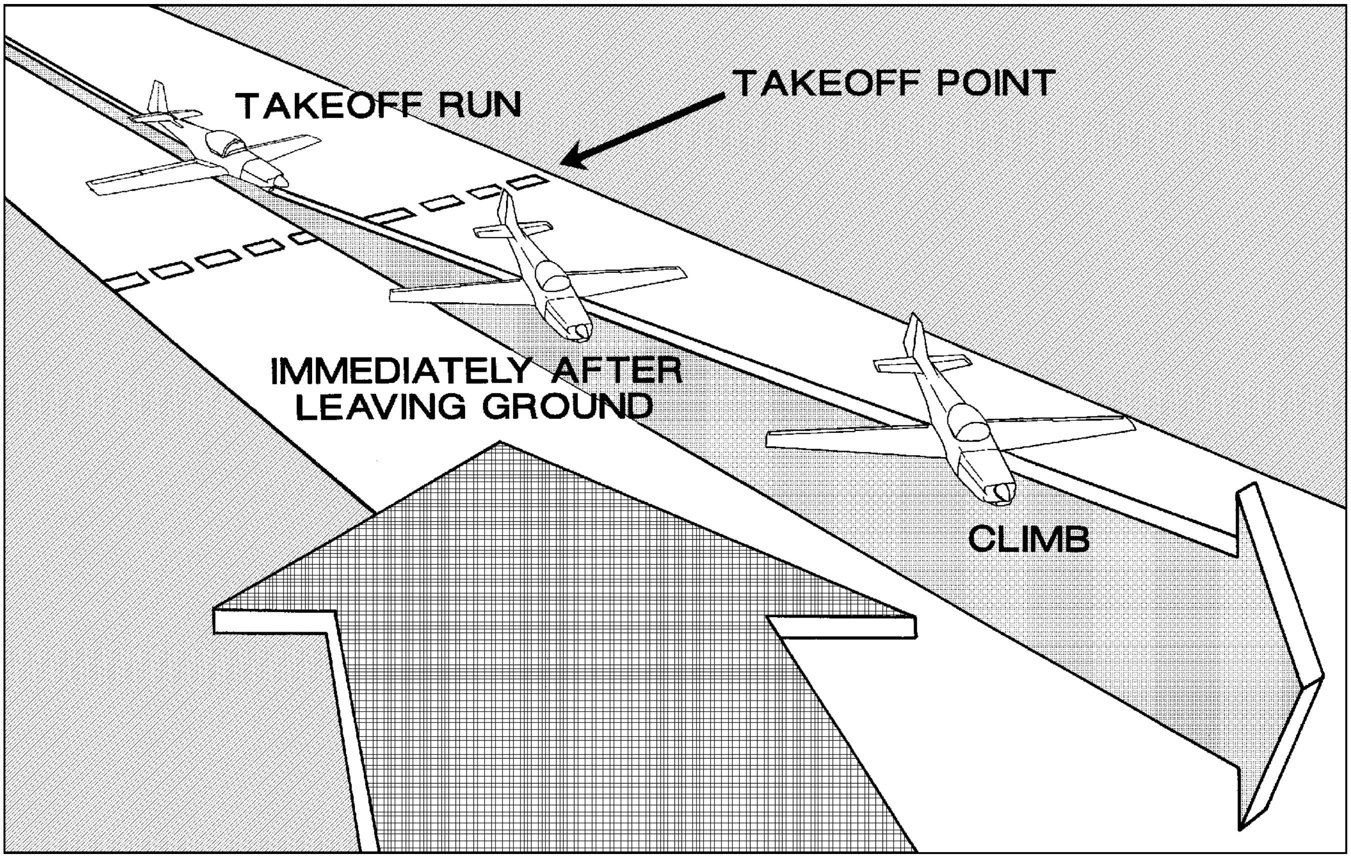

Figure 4.1. Crabbing Into a Crosswind After Takeoff.

entering and recovering from climbing turns. If you trim during the turn, don't forget to retrim when the wings become level. Also remember to clear in the direction of the turn throughout climbing turns.

4.5.5. **Level Off From Climbs**. Stop your climb at a selected altitude and establish level flight. Remember to use a lead point to ensure a smooth transition to the desired level off altitude. One technique is to use a lead point approximately 20 feet before the desired altitude. At the lead point, lower the nose of the aircraft to level flight. Adjust the power to obtain the desired airspeed and retrim the aircraft. Normal cruise airspeed is approximately 120-130 KIAS. As the airspeed increases, you will need to increase forward stick pressure to maintain level flight. Trimming is a continuous process from the time you lower the nose until the airspeed stabilizes. After leveling at cruise and (or) maneuvering altitude, perform the cruise check. This check is not required for intermediate level offs.

Chapter 5

CONTACT

Section A--Stall Training and Slow Flight

5.1. Introduction. Stall maneuvers and slow flight enable you to recognize attitudes, seat pressures, and the control feel signaling unsafe flight conditions. A thorough knowledge of these maneuvers will allow you to fly an airplane safely at maximum performance.

5.1.1. Before performing stalls or slow flight, ensure you accomplish the prespin checks described in AETCI 11-205. Setting neutral trim is only required for planned spin prevents and spins. If maneuvers are flown in a series, you are not required to check these items between individual maneuvers.

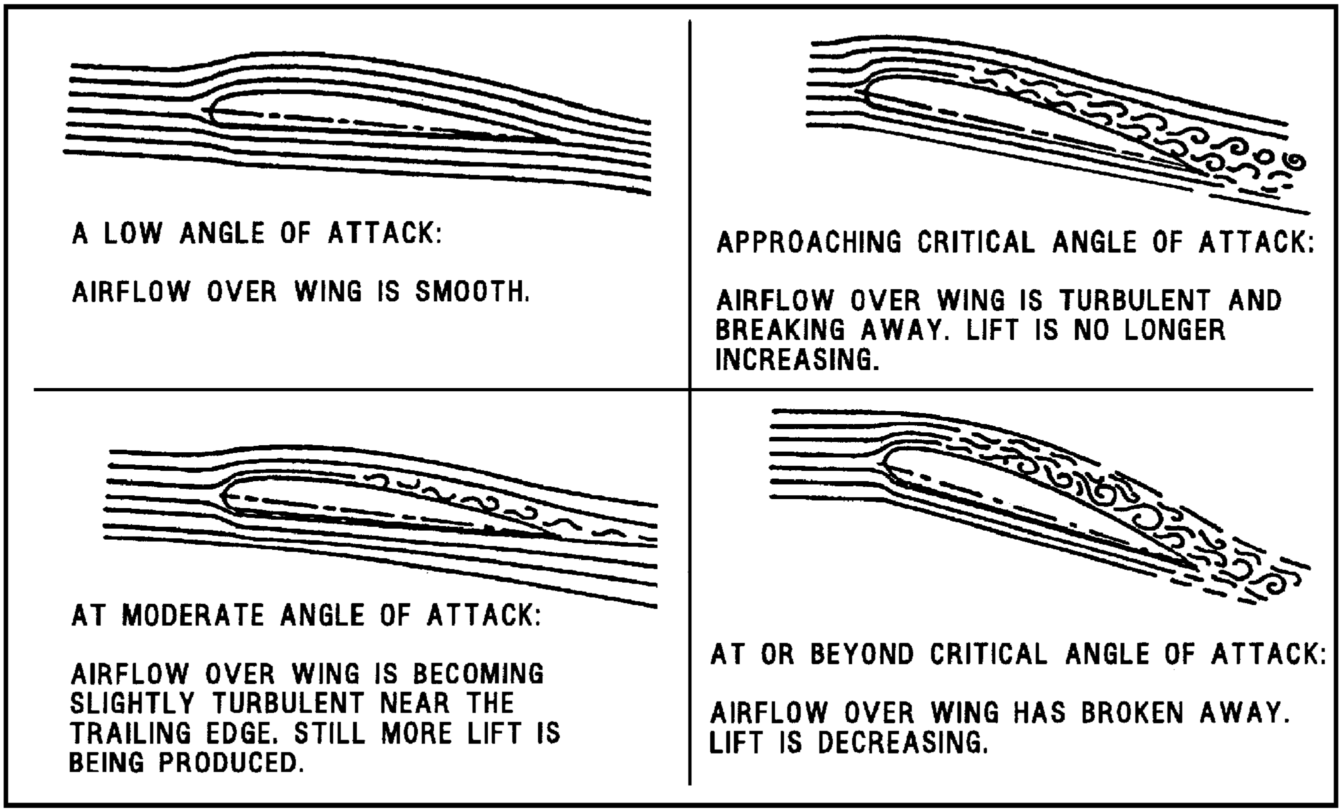

Figure 5.1. Airflow at Various Angles of Attack (AOA).

5.1.2. The stall is best defined as a condition where airflow over the top of the wing becomes separated from the surface of the wing. When this occurs, a turbulent wake develops on and behind the wing and the aircraft suffers a drastic reduction in lift. We are interested in this phenomenon because when the stall occurs, continued flight in the normal sense is no longer possible. If the stall condition is severe, the controls lose their effectiveness and sudden pitching and (or) rolling motions occur. As the stall progresses, you will lose control effectiveness in the following order: aileron, elevator, and rudder. During stall recovery, you will regain control effectiveness in the reverse order: rudder, elevator, and aileron. Obviously, a stall at low altitude is dangerous because you may lose considerable altitude during recovery. The following material outlines the conditions leading to a stall warning, stall, and stall recovery.

5.2. Conditions Leading to a Stall:

5.2.1. **Cause of Stall**. Basically, there is one cause for a stall: exceeding the critical AOA. The AOA is the angle between the chord line and the relative wind. Figure 5.1 shows a high AOA leads to airflow separation and the formation of a wake of turbulent air behind the wing. Separation begins at a certain AOA. A further increase in AOA causes separation on most of the top surface of the wing. It is important to realize an airplane can stall at any airspeed, attitude, or power setting if you demand (with the elevators) an AOA above the critical value. Stalls occurring at more than one G are often referred to as high speed, accelerated, or maximum turning dynamic stalls.

5.2.2. **Factors Affecting Stall Characteristics**. The factors affecting the stalling characteristics of the aircraft are weight, engine power, G or wing loading, and configuration (use of flaps).

5.2.2.1. **Effect of Weight.** If you increase the weight of the aircraft, more lift is required to support the extra weight. Additional lift is produced by either increasing the AOA or the airspeed. Maximum lift is obtained at the stalling angle so you must increase your airspeed to increase lift. The extra lift required from the wing (due to the added weight) leads to an increase in stalling speed.

5.2.2.2. **Effect of Power.** At a high AOA, the thrust line is inclined upwards and provides a vertical component of thrust acting opposite to the weight of the aircraft.. This effect is the same as reducing the weight of the aircraft, which results in lowering the stalling speed.

5.2.2.3. **Effect of G Loading.** If the airspeed is low, the aircraft will stall with light seat pressure and low Gs (for example, during the roundout and flare for landing). If the airspeed is high, you will feel considerable seat pressure and Gs when the AOA is sufficient to cause the stall (for example, when performing steep turns or aerobatics). Therefore, it is important to realize as you increase the angle of bank and load factor, the aircraft stalls at a higher airspeed.

5.2.2.4. **Effect of Configuration.** When you lower the flaps, you change the effective camber of the wing, increasing the coefficient of lift. This results in changing the stalling characteristics of the wing, reducing the stalling AOA and speed.

5.2.3. **How To Detect an Impending Stall.** To become a proficient pilot, you must recognize the flight conditions that cause stalls and know how to apply the necessary corrective action. You must learn to recognize an approaching stall by both sight and feel. You can see abnormal nose-high attitudes and decreasing airspeed leading to a stall. During turns and when pulling Gs, you can see the rapid motion of the nose as excessive back pressure is applied. You can feel the control pressures become light and less effective at low airspeeds. During rapid or steep turns, you can feel the excessive pressure forcing you into the seat as well as the excessive pressure you are applying to the controls.

5.2.4. **Stall Warning:**

5.2.4.1. The T-3 provides stall warning in the form of aural (warning horn), visual (flashing light), and airframe buffet indications. The aural warning and flashing stall warning light are activated at approximately 5 to 10 KIAS before the stall occurs, and they continue as the aircraft approaches a complete stall. A sensing vane located on the leading edge of the left wing activates the aural stall warning horn and stall warning light. Gravity holds the vane down in normal flight. As the AOA increases, a point is reached when the airflow comes from beneath the wing pushing the vane upwards, activating the warning horn and light. Airframe and control stick buffet occurs at approximately 2 to 3 KIAS prior to the actual stall. As the stall begins, the smooth airflow starts to separate from the wing in a small region near the wing root. The resulting turbulent wake strikes the tail and shakes the controls. This shaking or buffeting indicates the need to reduce the AOA to prevent a full stall.

5.2.4.2. The aircraft stalls at an AOA slightly higher than the angle where buffet begins. The separation spreads over most of the top rear portion of the wing (figure 5.1). As this happens in the T-3, the center of pressure on the wing moves sharply toward the trailing edge of the wing and the airflow over the tail surface becomes so disrupted the elevator can no longer hold up the nose. A sudden decrease in pitch takes place, often referred to as nose drop. Nose drop is easily noticed in the low-G, high-pitch attitude stalls. In addition, you may experience a wing drop (an unplanned rolling motion). The wing drop occurs if one wing stalls before the other because of an inadvertent rudder or aileron input, or if you delay the stall recovery and maintain back pressure, aggravating the stalled condition. The wing drop is more noticeable during accelerated or high-G stalls or during power-on stalls with flaps. During power-on stalls, expect a prolonged period of airframe buffet.

5.3. Stall Recovery. The T-3 has excellent stall-recovery characteristics with good control response into the actual stall. Because the elevator is affected by the propeller slipstream, it remains fairly effective as long as engine power is applied. Aileron control becomes marginal during a full stall, but rudder control is normally adequate to provide directional control. To recover from a stall or alleviate approach-to-stall indications, apply the stall recovery procedures. Do not think of these procedures as steps, one followed by another. Instead, apply them simultaneously because they all aid in the recovery.

5.3.1. In stall recovery procedures, reduce back stick pressure to decrease the AOA. Stick forces required to eliminate a stall will differ with every stall. Therefore, do not push forward on the stick to a predetermined point. At the same time, advance the throttle to full power. Anticipate the use of rudder to prevent yaw due to engine torque. As you feel the aircraft regain flying airspeed, return to level flight by establishing a level flight attitude for your airspeed and configuration.

5.3.2. Reducing the back pressure on the stick to decrease the AOA will restore lift. Thus, the stall is broken and the wing produces lift again. Although you may still be descending if the wings are severely stalled, the ailerons may be ineffective and will aggravate the stalled condition regardless of the finesse with which the aileron is applied. Use ailerons to level the wings only after the stall is broken.

5.3.3. Because the throttle is your only direct control over thrust, it is important to have maximum power to expedite the return to level flight by increasing the airspeed. When time is critical, as in low-altitude thrust-deficient situations, rapid throttle movement is the most efficient procedure to achieve maximum engine acceleration.

5.3.4. The stall recovery is not complete until the aircraft is returned to level flight. Avoid attempting too rapid a recovery, resulting in a secondary stall. Strive to develop a feel for flying the aircraft out of a stalled condition with minimum altitude loss.

5.4. Power-on Stalls. Power-on stalls are designed to teach you to recognize and recover from a nose-high attitude, full stall. Initiate recovery from these stalls when you lose control effectiveness. Control effectiveness is lost when the nose drops or an unplanned rolling motion takes place. You do not have to achieve full back stick before initiating recovery, and the exact point where the aircraft fully stalls is not considered a point of emphasis. It is important, however, for you to see how an airplane behaves if you don't recover from the stall at the first buffet indication. Adjust the throttle to obtain a manifold pressure of approximately 12 to 18 inches. Clear the area. Pay particular attention to the area above, below, and in front of your aircraft. It is not necessary to clear before each individual stall maneuver unless you pause too long between maneuvers and fly out of the area you have previously cleared.

5.4.1**. Straight-Ahead Stall**. To execute a straight-ahead, power-on stall, raise the nose to a pitch attitude between 15° and 50°. Your IP will describe the outside references to use. Slowly and smoothly increase back pressure to hold this attitude until stall occurs. Keep the wings level with aileron pressure.

5.4.1.1. Recover by using stick forces as necessary to decrease the AOA and smoothly advance the throttle to full power. Note the large pitch change needed to recover. Allow the nose to lower until you feel positive pressure on the controls, indicating the aircraft is regaining flying airspeed. Cross-check the airspeed and recover with minimum loss of altitude without encountering a secondary stall. The maneuver is complete when you have returned to level flight.

5.4.1.2. At lower pitch attitudes (between 15° and 30°), the aircraft stalls at a relatively high airspeed. Shortly after you lower the nose, the aircraft will regain flying airspeed. At higher pitch attitudes (between 30° and 50°), the stall speed is slower and you will need a greater pitch change to regain flying airspeed.

5.4.2. **Turning Stall**. Execute the turning stall in much the same manner. The pitch and power are the same in the turning stall as they were in the straight- ahead stall. Use 20° to 30° of bank in either direction. From straight-and- level flight attitude, set the pitch attitude between 15° and 50° and establish the desired bank. When you reach this attitude, hold it by using ailerons and elevator until the stall occurs; then recover straight ahead as you did in the straight-ahead stall. A precision entry is not as important as proper recognition and recovery from fully stalled conditions.

5.5. Traffic Pattern Stalls. You will practice traffic pattern stalls to become proficient in recognizing and recovering from stall conditions that could occur in the traffic pattern when you are rapidly cross-checking all available outside and instrument references. The emphasis is on recognizing the approach to stall and the use of recovery procedures, not how the stall series is set up or the flow from one stall to the other. Initiate recovery when you recognize an approach-to-stall indication. Buffeting is the best indication of an approach to stall. If a stall indication actually occurs in the traffic pattern, make no attempt to comply with the normal ground track. Recover the aircraft by using the following procedures to safely regain aircraft control.

5.5.1. **Break Stall**. On a simulated initial, adjust power to maintain 120 knots. Execute the break (clear the area) and reduce power as you would in the traffic pattern. After you establish the turn, steadily increase bank and back pressure until you recognize an approach-to-stall indication. At this point, execute an immediate recovery by using stick forces as necessary to decrease the AOA. Adjust the bank angle as necessary to reestablish level flight and continue to approximately the 180° point, simulating a downwind leg. When determining the effectiveness of this maneuver, do not consider the altitude lost or gained before the stall.

5.5.2. **Overshooting Final Turn** On the simulated downwind leg, configure for a normal overhead pattern. Approaching final turn airspeed, initiate a normal final turn. After establishing the turn, simulate an overshoot by steadily increasing bank and back pressure until you recognize an approach-to-stall indication. If flaps are extended, use caution not to exceed flap extended "G" limitations. Recover by simultaneously relaxing stick forces as necessary to decrease the AOA, advancing the throttle to full power and leveling the wings, using ailerons and rudder. Return to level flight as soon as possible. Do not lose any more altitude than necessary.

5.5.3. **Undershooting Final Turn** On a simulated downwind leg, configure for a normal overhead pattern. Begin a normal final turn. After establishing the turn, raise the nose slightly and shallow the bank. Continue to turn until you recognize an approach-to-stall indication. Recovery is the same as the overshooting final turn approach-to-stall except airspeed is lower and the recovery will take longer.

5.5.4. **Landing Attitude Stall**. Establish a simulated final approach, retard the throttle to idle, and execute a normal roundout for landing. Hold the landing attitude constant until you recognize an approach-to-stall indication. At that point, execute a normal stall recovery. Remember, any time you recover from stalls with the flaps down, be careful not to exceed the flap limiting airspeeds.

5.5.5. **No-Flap Stall**. You will also practice no-flap traffic pattern stalls. In performing the stalls without flaps, use the same configuration, airspeeds, and power settings as in the no-flap landing pattern. While performing these stalls, be aware of the differences in aircraft buffet, pitch attitudes, and stalling airspeeds. (***NOTE:*** After completing the first instructional unit requiring traffic pattern stalls, the break stall is optional. You may start from a simulated downwind position, but you must clear the area. The sequence of the turning stalls is unimportant. Your instructor pilot (IP) has the option of having you fly only one of the turning stalls during the series.) When performing both, one should be recovered on the buffet and the other on the stall warning horn or light. Additionally, the IP may demonstrate the approach-to-stall characteristics in various traffic pattern configurations.

5.6. Secondary Stall. A secondary stall is a form of an accelerated stall caused by excessive elevator control. It is called a secondary stall because it occurs after a partial recovery from a preceding stall. A secondary stall is caused by attempting to hasten a stall recovery when the aircraft has not regained sufficient flying speed. This stall demonstration is designed to show you what will happen if you rush the return to level flight after a stall or spin recovery. It also teaches you the value of smooth back pressure at critical airspeed and the importance of allowing an aircraft to begin flying before completing a stall recovery. The secondary stall is usually demonstrated after a partial recovery from a power-on stall. Clear the area and perform a normal power-on stall. When the stall occurs, initiate a recovery. Then steadily bring the stick back as if you were trying to rush the return to level flight. Continue to increase back pressure until the aircraft buffets and the nose stops tracking. When this occurs, use normal stall recovery procedures. Note the throttle is full forward when you enter the secondary stall.

5.7. Slow Flight:

5.7.1. **Slow-Flight Practice**. Slow flight will acquaint you with the characteristics of the aircraft at minimum flying speeds and will demonstrate the importance of smooth control application. You will practice slow flight to develop your feel for the aircraft and your ability to use the controls correctly. This improves your proficiency in performing low airspeed maneuvers. You may enter slow flight after the traffic pattern stalls or by reducing the airspeed and configuring for the maneuver. When the airspeed is below 98 knots, lower the flaps if desired and continue to maintain altitude while the airspeed decreases. As the speed decreases, adjust the power to maintain 60 to 70 KIAS. Use back pressure and trim as necessary to maintain altitude throughout these changing flight conditions. Anticipate the use of right rudder to compensate for the effects of torque. The exit from slow flight should be performed as a level straight-ahead go-around with a return to cruise flight.

5.7.2. **Slow-Flight Demonstration**. Your IP will demonstrate the following handling characteristics of the T-3 at minimum flying speeds and will have you fly some of these to build your proficiency in the aircraft. These demonstrations will help you recognize attitudes and characteristics leading to unsafe flight conditions. During slow-flight demonstrations, recover at the first indication of the approach to stall by alleviating the condition that caused the stall (decreasing the AOA, lowering the flaps, or decreasing the bank). However, this is not the primary method of stall recovery. It is used only to enhance the effectiveness of the slow-flight demonstration. If the stall or approach-to-stall indications occur at any other time or if the stall condition is not immediately alleviated, initiate a normal stall recovery. Excessively rough control movement at minimum airspeed or a delay in initiating recovery action after a stall or approach-to-stall indication may result in an inadvertent spin. You are not required to duplicate these demonstrations except for straight-and-level flight and the coordination exercise.

5.7.2.1. **Straight-and-Level Flight.** To maintain straight-and-level flight while decelerating, you must increase pitch attitude to maintain altitude and increase power to maintain airspeed.

5.7.2.2. **Control Effectiveness.** The aircraft reacts slowly to control inputs as the speed decreases. Also, you will need to deflect the control surfaces more to achieve the desired aircraft response.

5.7.2.3. **Adverse Yaw.** You will also need additional displacement of the ailerons at slow airspeed to achieve the same aircraft response as normal cruise airspeeds. This creates more drag and a noticeable yaw away from your direction of turn. Use coordinated rudder to correct adverse yaw.

5.7.2.4. **Turns.** The rate an aircraft turns is determined by the angle of bank and airspeed. The slower an aircraft is moving through the air, the greater the rate of turn for any given angle of bank.

5.7.2.5. **Steep Turns.** At minimum flying speed, the increased wing loading in a steep turn causes a stall. This is clearly demonstrated by smoothly increasing bank while attempting to maintain altitude. Recover at the first indication of an approach to stall.

5.7.2.6. **Increasing Pitch Attitude.** This demonstration illustrates the small margin between slow flight and stall. Any attempt to increase the pitch attitude will quickly result in a stall with or without effective stall warning, depending upon the abruptness and magnitude of the pitch change. From straight-and-level slow flight, raise the nose slightly without increasing power. Notice how quickly the airspeed dissipates and the stall warning begins. Lower the nose and regain slow flight airspeed at the first indication of the approach to stall.

5.7.2.7. **Raising the Flaps.** First raise the flaps to 18° and maintain altitude. The aircraft will accelerate as a result of the reduced drag. Reestablish slow- flight airspeed by returning the flaps full down and adjusting power if necessary. Next, fully retract the flaps. To maintain altitude, you must increase the pitch attitude. As a result of the lower lifting capability and low airspeed, the aircraft will stall. Recover at the first indication of the approach to stall by lowering the flaps or by a stall recovery.

5.7.2.8. **Coordination Exercise.** Coordinated flight during slow flight requires proper application of aileron, elevator, rudder, and power. While practicing slow flight coordination exercises, use approximately 15° banked turns, turning approximately 20° to each side of a central reference point.

Section B--Recoveries From Abnormal Flight

5.8. Recovery Procedures. Throughout your flying career, and particularly during pilot training, you will find that occasionally maneuvers will not go as planned because of improper flight procedures and (or) disorientation. You may arrive at a flight attitude and airspeed where you could lose aircraft control unless you initiate proper recovery procedures. This is especially true when flying aerobatic maneuvers. The key to recovery is early recognition of an improperly flown maneuver. When you recognize a deteriorating situation, apply the appropriate recovery procedures. Do not delay the recovery in an attempt to salvage a poorly flown maneuver. As your proficiency increases, your IP will continue to challenge and develop your ability to recognize recovery situations. When you reach the aerobatic phase, your IP will intentionally fly some poorly performed maneuvers, requiring you to apply these procedures.

5.9. Recovery From Inverted Flight. The correct procedure to recover from inverted flight is to roll to the level-flight attitude. The technique is the same as in any rolling maneuver. Roll in the shortest direction to an upright attitude. When possible, maintain a fairly constant pitch attitude during the recovery. If you have low airspeed, let the nose of the aircraft lower while performing the rollback to the level-flight attitude. This prevents a stall and a potential excessive loss of altitude. Your IP will give you the opportunity to practice this recovery technique. He or she will fly the aircraft into an inverted attitude and then let you make the recovery. The correct recovery technique is a coordinated rollback-to-flight.

5.10. Nose-Low Recoveries. Many of the maneuvers demonstrated and practiced in flying training will result in intentional or unintentional nose-low attitudes. The following information will provide you with a sound basis for a recovery technique:

5.10.1. Recover from a nose-low attitude with smooth back pressure as you roll to a wings-level attitude. Start the recovery before the airspeed approaches the aircraft limitations. Any time you are in a nose-low recovery situation with airspeed rapidly increasing, adjust the throttle to idle and return the aircraft to level flight. Other situations may occur with low airspeed and shallow pitch attitudes. In these instances, you may modify the recovery procedures to return to level flight with flying airspeed. Recovery should not involve the use of maximum allowable G forces unless the altitude available for recovery is critical. (Severe damage to the aircraft may result if design G limits are exceeded.) You will notice increased wing loading when you feel the increased seat pressure after applying back pressure to the stick. Airspeed and G loading may increase during the pullout. Perform a proper anti-G straining maneuver (AGSM) (paragraph 5.13.1).

5.10.2. Recover from a nose-low attitude smoothly without excessive airspeed or loss of altitude. When practicing a nose-low maneuver, do not exceed maximum allowable airspeed (195 knots). Remember, the airspeed does not stop increasing as you begin raising the nose. It may increase until just before you attain level flight. Should you exceed limiting airspeed, abort the mission and make an entry in the AFTO Form 781. This writeup will result in an overall inspection of the aircraft's structure.

5.11. Nose-High Recoveries. You will intentionally fly the T-3 through nose-high flight attitudes many times during aerobatic practice. Occasionally, because of improper control, you may find yourself in nose-high attitudes with less than optimum airspeed to continue the maneuver. Unless you initiate immediate and proper recovery procedures, the aircraft may enter an aggravated stall resulting in a spin.

5.11.1. The objective of the nose-high recovery is to fly the aircraft to level flight as soon as possible without stalling. To do this, adjust the throttle to full power and initiate a coordinated roll to bring the nose of the aircraft down to the nearest horizon. Depending on the initial airspeed and aircraft attitude, you may reach a wings-level, inverted attitude. As the nose approaches the horizon, roll to an upright attitude. Depending on the airspeed, you may need to delay the rollout until the nose is definitely below the horizon.

5.11.2. During some nose-high situations when aircraft airspeed is too low or dissipating rapidly, it may not be possible to use normal recovery control inputs without approaching or encountering a stalled condition. Under these conditions or during disorienting nose-high situations, use an unloaded recovery to return the aircraft to level flight. This is done by simultaneously advancing the throttle to full power and holding the flight controls in the neutral position. After neutralizing the controls, expect the airspeed to dissipate and the nose to lower as the aircraft seeks to regain flying airspeed. Initially, aircraft control authority is minimal. However, as airspeed increases during the dive, control inputs will become more effective. Allow the nose to lower until you feel positive pressures on the controls. You may need to lower the nose near vertical during this stage of the recovery. On regaining flying airspeed, recover the aircraft to level flight. Keep in mind that an unloaded recovery may result in considerable altitude loss.

5.11.3. Initially, your IP will have you practice both techniques for recovery. As you gain proficiency, he or she will allow you to decide on the best technique for a given situation. At times you may attempt a nose-high recovery and have to transition to the unloaded technique because of insufficient airspeed or an approach-to-stall indication. However, you should learn to evaluate the existing situation and decide on the appropriate recovery technique.

Section C--Aerobatics

5.12. Performing Aerobatic Maneuvers. Aerobatic maneuvers help you develop and perfect your technique for operating an aircraft to obtain maximum flight performance. These maneuvers are smoothly executed and explore the entire performance envelope of the aircraft. You will learn aerobatic maneuvers to help you develop a more sensitive feel for the aircraft and improve your ability to coordinate the flight controls and remain oriented, regardless of attitude. You will also learn to put the aircraft where you want it. Learning to perform aerobatics skillfully will increase your confidence, familiarize you with all attitudes of flight, and increase your ability to fly an aircraft throughout a wide performance range. Aerobatics will also teach you to feel at ease when your body is oriented at any angle. You will realize that you can think, plan, observe, and perform as easily inverted as upright.

5.12.1. Training emphasis is on smoothness and proper nose track during the maneuver rather than on meeting exact entry parameters. Do your part to prevent loss of consciousness (LOC) episodes by avoiding unexpected, rapid, or abrupt control inputs when you are flying the aircraft and anticipating increased G loading when the IP is flying.

5.12.2. Use the specified entry parameters for aerobatic maneuvers. When an airspeed range is specified, pick a specific airspeed and fly the maneuver. Continually strive for precision when flying these maneuvers. Normally, your left hand is on the throttle and your right hand is on the control stick. There may be some maneuvers you may want to fly with both hands on the stick. Conscientious practice of these maneuvers will pay big dividends in providing you knowledge of control pressures, timing, and planning, all of which are necessary for precision flying.

5.13. Increased G Maneuvering. During aerobatic flying you will perform maneuvers at different and constantly changing G levels. This is especially true of any maneuver that starts with an extreme nose-down attitude at low airspeed and transitions to increasing airspeeds and higher G loads, (for example, nose-low recoveries, spin recoveries, and split-S maneuvers). An anti-G straining maneuver (AGSM), also referred to as an L-1, is essential to maintain maximum alertness and avoid grayout, blackout, or LOC during aerobatic flight.

5.13.1. **Starting the AGSM.** It is important to start the AGSM (L-1) before the onset of the G forces and maintain the strain throughout the period of increased G loading. The amount of strain required will vary with the amount of applied G force. When encountering high-G situations, all elements of the AGSM are required. During an AGSM, anticipation of the necessary strain, full muscle contraction, and constant breathing cycles become vital. There will be lower G situations that do not normally require a full AGSM, but use lower body tension. Your IP will provide guidance on how to properly accomplish the AGSM and will ensure you can perform it properly. To accomplish the AGSM, firmly contract the muscles of the legs, arms, and abdomen and take as big a breath as possible. You will also need to tighten your chest muscles and try to exhale against a closed airway while continuing to tighten your lower body. Then pull back on the stick. Breathe (a quick air exchange) approximately every 3 seconds. (This is a small air exchange--about 20 percent of the lungs capacity.) Think about the AGSM as a continuum. As the amount of Gs increases, you will need to increase the intensity of the strain, paying careful attention to proper breathing techniques. Do not let up on lower body tension throughout the flight maneuver. It is also important not to hold your breath too long without air exchange because this will reduce G tolerance (by starving the heart pump). If grayout occurs at the onset of G forces, application of the AGSM may not eliminate the grayout. If excessive vision loss occurs or if altitude and (or) airspeed are not critical, return to 1 G flight, reapply the AGSM, and then continue maneuvering.

5.13.2. **AGSM Demonstration**. Your IP will perform a demonstration flight maneuver to allow you to practice your AGSM technique and familiarize you with increased G flight. The demonstration will consist of a series of turns, each at a constant G level, with a break between turns for critique and rest. The flight maneuver will be flown at gradually increasing G levels, starting at 2 Gs and increasing to 3 to 4 Gs depending on your proficiency.

5.13.2.1. Your IP will advise you before the flight maneuver to ensure you are prepared. If at any time you approach your G tolerance, tell your instructor. It is important the demonstration be of sufficient duration to ensure you can perform the AGSM properly (at least four to five breathing cycles).

5.13.2.2. Remember, while flying aerobatic maneuvers you will be exposed to different G levels. By anticipating these Gs early and performing the AGSM properly, you may avoid grayout, blackout, and LOC.

5.13.3. **G-Awareness Exercise**. On any contact sortie where increased Gs are anticipated, you must perform a G-awareness exercise (if an AGSM demonstration is not accomplished). During those sorties, perform the G-awareness exercise before flying any maneuver that may result in increased Gs. The G-awareness exercise should be a level or slightly descending turn of approximately 180°. G onset should be slow and smooth, allowing sufficient time to evaluate the effectiveness of your AGSM and determine your G tolerance. Begin the maneuver with 2 Gs and increase to approximately three to four Gs. If you begin to grayout during the maneuver, return to 1 G flight, reevaluate your strain, and then slowly and smoothly reenter the G-awareness exercise.

5.14. Energy Maneuvering. A good knowledge of energy planning will enhance your ability to use time, fuel, and an assigned altitude block. Total energy is a combination of altitude (potential energy) and airspeed (kinetic energy). One can be traded for the other. To trade altitude for airspeed, lower the nose and set full power. Plan your maneuvers to flow from one to another. Spins, traffic pattern stalls, the cloverleaf, the split S, nose-low recoveries, excessive Gs, and steep-banked turns are energy-losing maneuvers. Energy-gaining maneuvers include power-on stalls, nose-high recoveries, the chandelle and the Immelmann.

5.15. Loop. The loop is a 360° turn in the vertical plane (figure 5.2). Because the maneuver is executed in a single plane, the elevator is the primary control. Use the ailerons and rudder for coordination and directional control. The objective of the maneuver is to maintain a constant nose track.

5.15.1. To remain oriented, select a road or section line for a ground reference. Align the aircraft with the reference and keep them aligned throughout the loop. Adjust the throttle to full power and attain the entry airspeed of 130 to 150 knots as you return to level flight.

5.15.2. Increase back pressure to pull the nose up at a constant rate. If you pull up too fast, you may exceed the critical AOA and stall. If your initial pullup is too slow, you will be too slow over the top and the aircraft may stall. (If the aircraft stalls at the top of the maneuver, it will roll out similar to having completed an Immelmann-type maneuver.) Centrifugal force will cause you to feel a definite seat pressure. Use this seat pressure (initially about 3-4 Gs on the accelerometer) to determine the correct rate of movement of the nose. (For example, if there is very little seat pressure, your pullup is too slow.) Maintain the initial rate of nose movement throughout the maneuver by adjusting back pressure. As you deplete airspeed in the pullup, you will need less back pressure to maintain a constant rate of nose track. Use aileron and rudder pressure to keep the wings level throughout the maneuver.

5.15.3. When you can no longer see the horizon ahead, look at the wingtips and keep them equidistant from the horizon. After passing the vertical flight position, tilt your head back and watch for the horizon to appear. Use the horizon to maintain a wings-level attitude. Locate the reference on the ground you used to begin the maneuver.

5.15.4. As you reach the inverted position, adjust the back pressure to maintain a constant rate of nose movement. Use aileron pressure as needed to keep the wings level. As the nose passes through the horizon and the aircraft reenters a dive, increase back pressure to return to the level-flight attitude. Throughout the last half of the maneuver, use the ground reference to

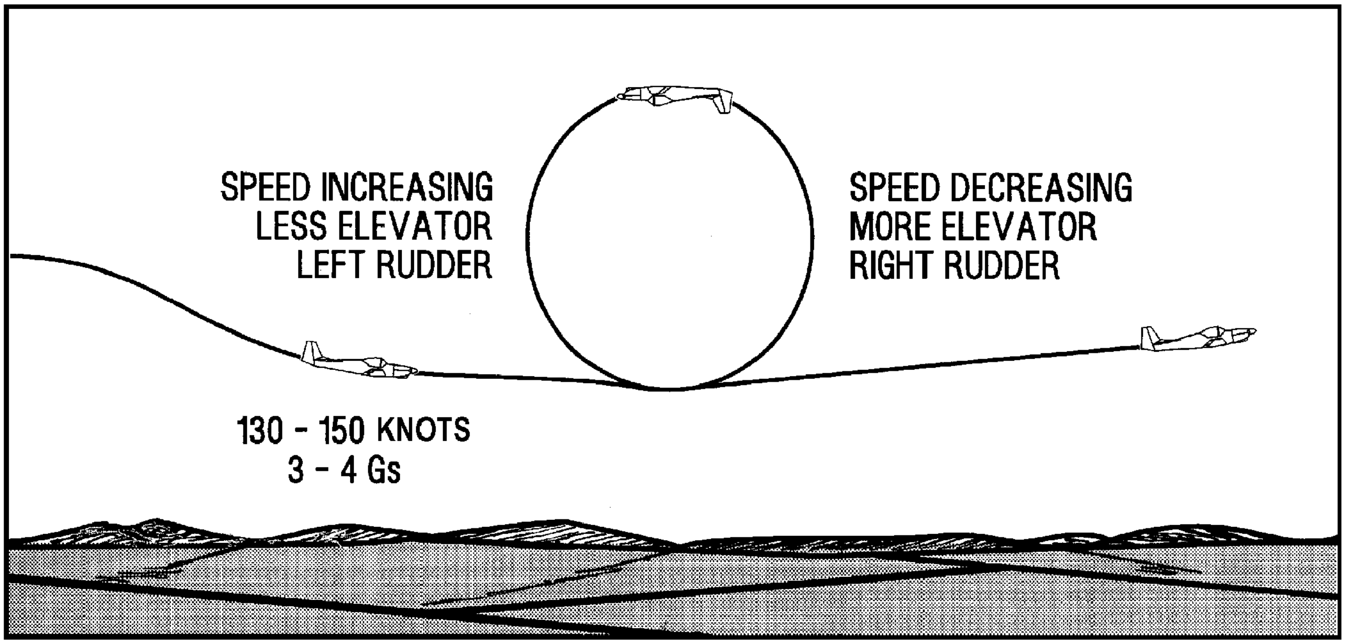

Figure 5.2. Loop.

maintain the desired vertical plane. It is not necessary to complete the maneuver at entry altitude or airspeed.

5.15.5. Throughout the loop, you will need to use rudder to compensate for the torque. If you don't use rudder, your loop will not be straight.

5.16. Aileron Roll. The aileron roll is a coordinated 360 roll done in either direction (figure 5.3). Adjust the throttle to full power and attain the entry airspeed of 120-130 knots. Smoothly raise the nose to 20° to 30° pitch attitude, relax back pressure, and initiate the roll by applying aileron and coordinated rudder pressure. After the aircraft begins the roll, continue coordinated control pressure to maintain the desired rate of roll. Make no attempt to keep the nose on a point. As you approach the wings-level attitude, gradually release aileron and rudder pressure to ensure a smooth coordinated return to wings level.

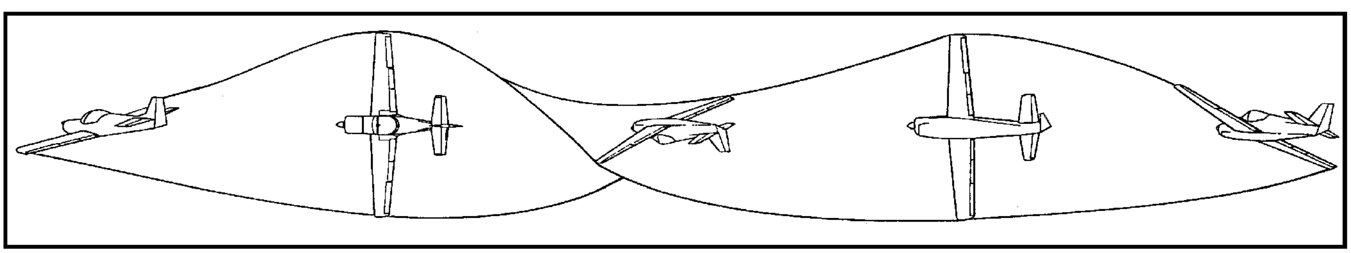

Figure 5.3. Aileron Roll.

5.17. Split S. The split S demonstrates how much altitude is lost if recovery from inverted flight is attempted in this manner (figure 5.4). It is basically the same as the last half of a loop. Clear the area, keeping in mind the aircraft climbs during entry and descends during recovery. From straight and level flight with 120-130 knots, raise the nose to a 20° to 30° pitch attitude and set the power at idle. Roll the aircraft to a wings level, inverted attitude. As the airspeed reaches approximately 90 knots, apply back pressure to bring the nose through the horizon. Hold back pressure (approximately 3-4 Gs or the light buffet). Airspeed and G loading will increase during the pullout. Remember to perform a proper AGSM. The maneuver is complete when the aircraft returns to level flight.

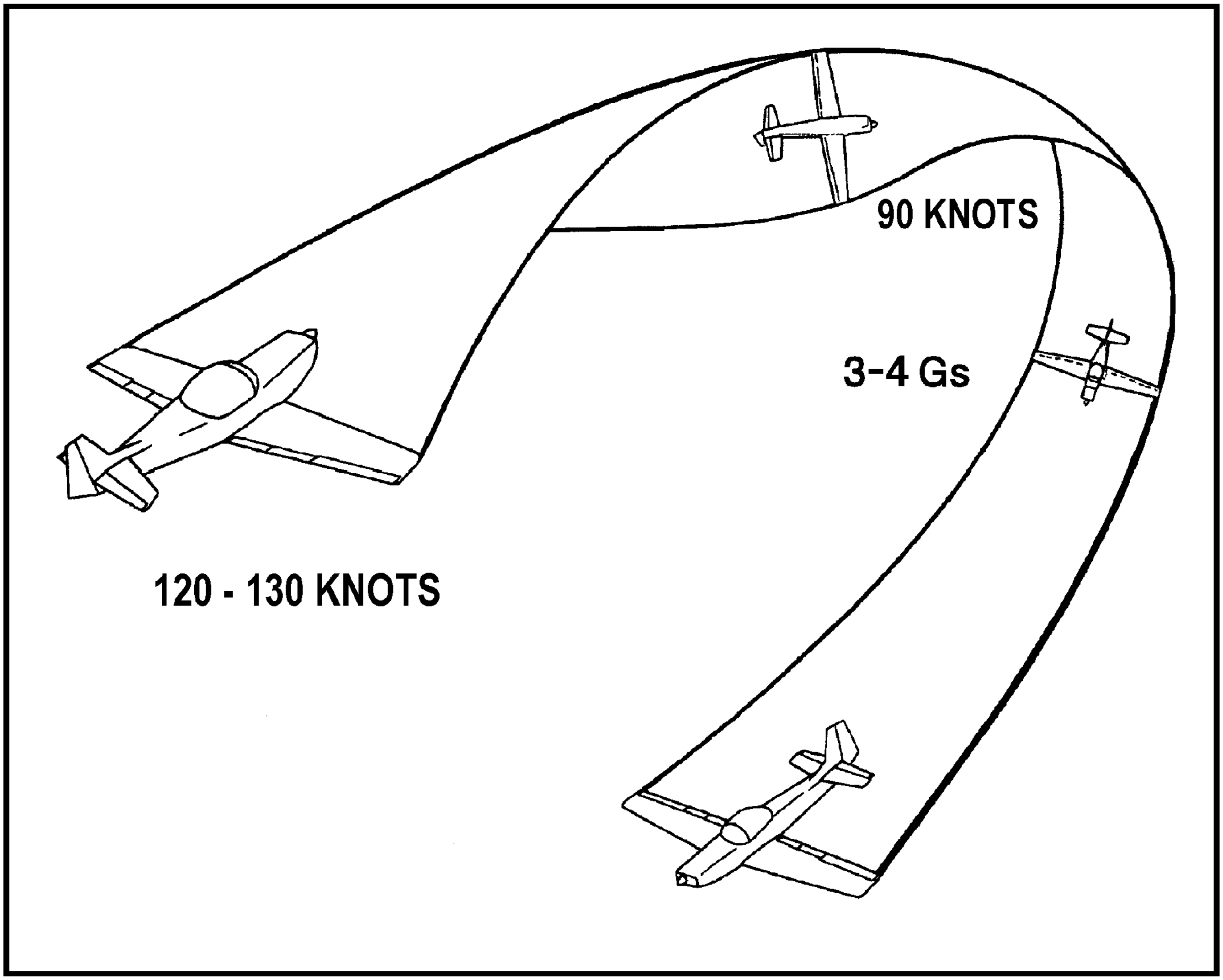

Figure 5.4. Split S.

5.18. Chandelle. The chandelle is a precision 180° steep climbing turn with a maximum gain of altitude (figure 5.5). Use full power for the maneuver.

5.18.1. Look in the direction of the turn and clear while performing the maneuver. Enter the maneuver with full power and the nose approximately 10° below the horizon. When the airspeed reaches 130 knots, blend rudder, aileron, and elevator pressure simultaneously to begin a climbing turn. Allow the bank to keep increasing and the nose track to keep rising at a uniform rate. The nose should describe a straight line diagonal to the horizon, passing through the horizon between 30° to 45° of turn with a maximum bank angle of 60°.

5.18.2. Check the amount of turn by using outside references. Time the bank-and-pitch increase so when the nose passes through the horizon, your bank is approximately 60°. (Cross-check the attitude indicator and outside references.) At this point, the vertical component of lift decreases, requiring considerably more back pressure to keep the nose rising at a uniform rate. Continue to observe the amount of turn by checking outside references. As soon as the 135° point in the turn is reached, start the rollout.

5.18.3. Allow the nose to continue to rise at a uniform rate. Some lift is gained by decreasing the angle of bank; some lift is being lost by decreasing the airspeed. These variables require constant changes in control pressures to keep the nose rising at a constant rate.

5.18.4. Continue to observe the amount of turn remaining before reaching the 180° point by checking outside references. Time the rollout so the wings become level and the nose reaches the highest pitch attitude at the

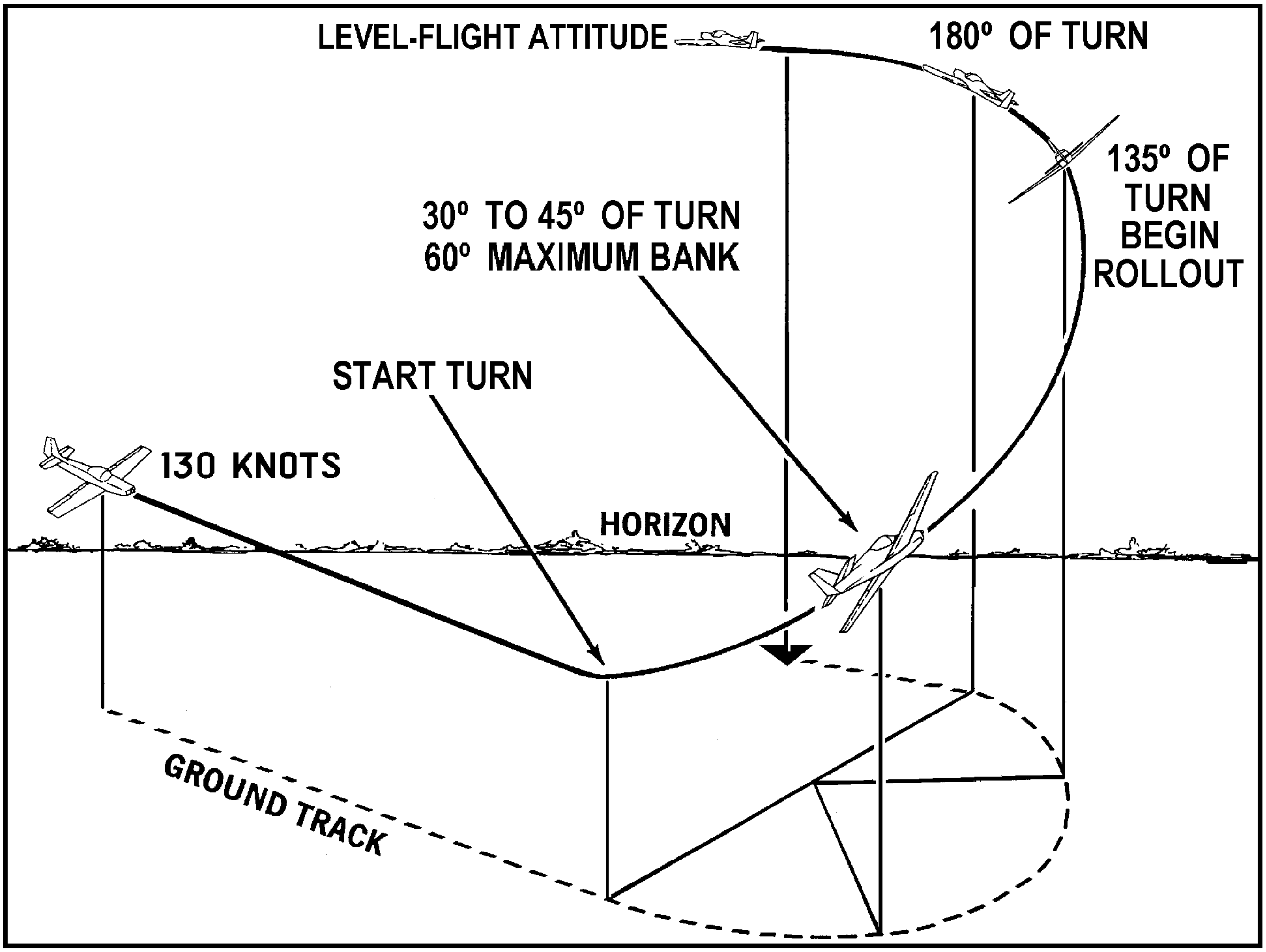

Figure 5.5. Chandelle.

180° point. Hold this pitch attitude momentarily. Cross-check outside references to maintain your heading. Lower the nose to level flight for the existing airspeed. Airspeed should be approximately 5 knots above a stall and sufficient to maintain altitude.

5.18.5. If the rate of climb is too fast, the aircraft will approach a stall before turning 180° and you must discontinue the maneuver. If the rate of pitch change is too slow, you may reach the 180° point before you attain the maximum pitch attitude. If you plan to pull fast, roll in fast; if you plan to pull up more slowly, roll in slowly.

5.18.6. One point must be emphasized. When starting the maneuver, the roll rate in is faster than the rate of pullup. The result is a greater change in bank than in pitch from the beginning to the completion of the maneuver. The bank will increase to 60° and then back to level. The total pitch change may only be 55° or 60°. The nose should describe a straight diagonal line in relation to the horizon from the lowest point at the beginning of the maneuver to the highest point at the 180°position.

5.18.7. Time the maneuver so you will not have to lower the nose to prevent a stall before you level the wings. After you level the wings, complete the maneuver by lowering the nose to level flight before a stall occurs.

5.19. Barrel Roll. A barrel roll is a coordinated roll in which the nose of the aircraft describes a circle around a point on the horizon (figure 5.6). Maintain definite seat pressure throughout the roll. Practice the barrel roll in both directions. There is little or no net loss or gain of altitude from the maneuver.

5.19.1. Select a reference point on or near the horizon--a cloud or landmark. Attain the entry airspeed of 130 knots by diving the aircraft while clearing. Attain this airspeed with the nose of the aircraft below the reference point. Use full power during the maneuver.

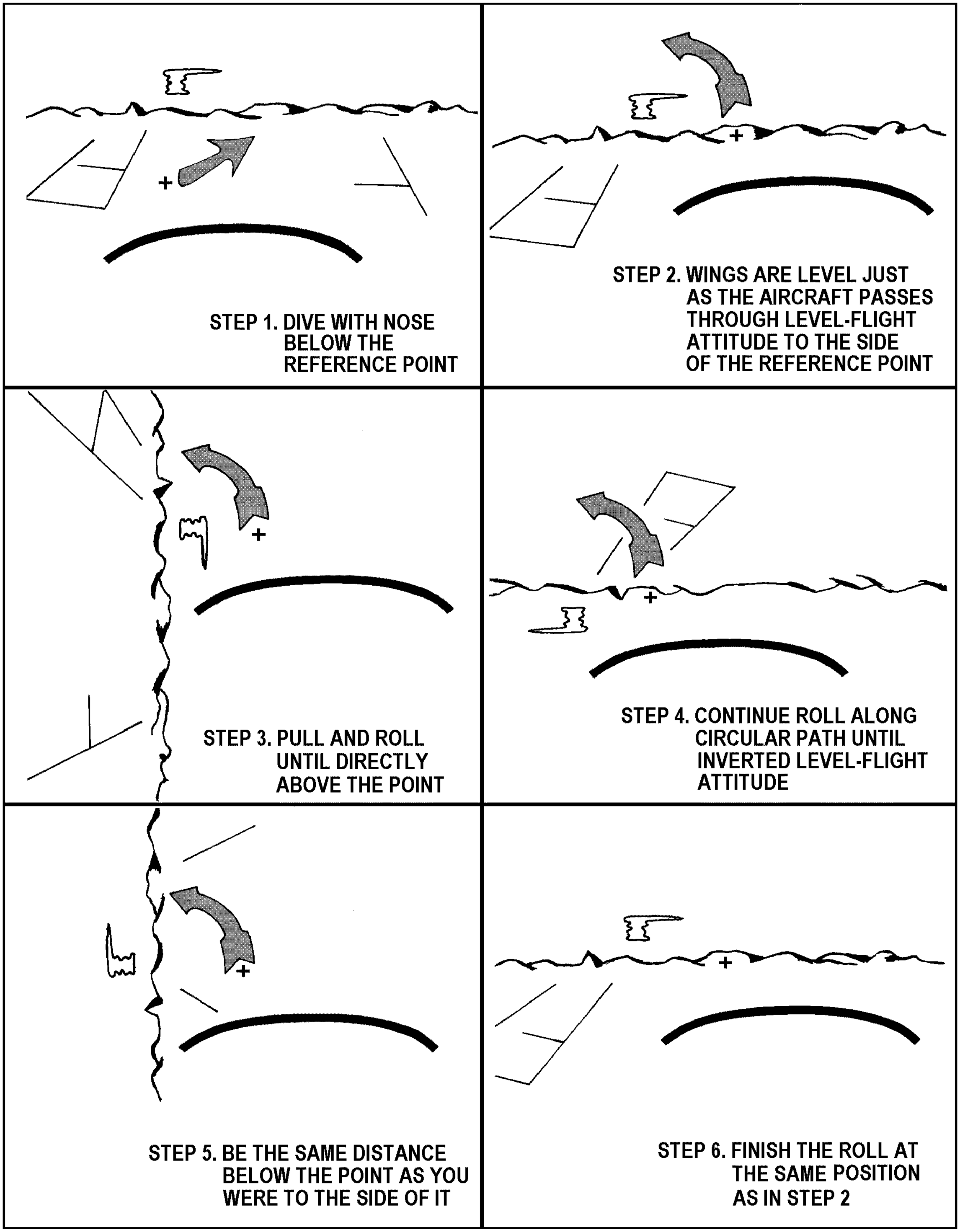

Figure 5.6. Barrel Roll.

5.19.2. Begin a coordinated turn in the opposite direction of the desired roll. Keep the aircraft nose below level flight until it has turned 20° to 30°to the side of the reference point. Then begin rolling out of the initial turn and allow the nose to rise so the wings are level just as the aircraft passes through a level-flight attitude. At this point, distance to the side of the reference point depends on the speed of the rollout. This distance from the reference point should remain the same throughout the barrel roll.

5.19.3. From level flight, continue with coordinated stick and rudder pressure, causing the climb and bank to increase. As the aircraft reaches 90° of bank, the aircraft should be at its highest pitch directly above the reference point. After you pass this position, relax some of the back pressure, but continue the roll by blending in more aileron pressure. If you hold the same amount of back pressure as you did in the first quarter of the roll, you will pull the nose down too fast in relation to the horizon because gravity is now assisting lift (downward). Plan the roll so the wings become level just as the aircraft reaches the inverted level-flight attitude. The aircraft nose track should now be the same distance on the opposite side of the reference point as it was at the beginning of the maneuver. The aircraft nose should have described a semicircle about the reference point. As the aircraft passes this position, continue the roll and begin applying increased elevator pressure.

5.19.4. As the aircraft again reaches 90° of bank at the bottom of the maneuver, the nose track should continue to be an arc of a circle with the reference point at its center. In this last quarter of the roll, you must begin to blend in more elevator and maintain coordinated control pressures to continue the roll so the nose track completes the circle around the reference point while positive seat pressures are held throughout the roll. The reason for blending in additional aileron pressure at the highest point of the roll is to maintain a constant roll rate. Because the nose is rising continuously up to this point and the airspeed is decreasing, the ailerons are less effective than they were at the beginning of the maneuver. This means the roll rate will slow down unless you deflect the ailerons more throughout the maneuver.

5.19.5. Remember, these control effects apply to any rolling aerobatic maneuver. The ailerons roll the aircraft, and you should maintain a constant roll rate throughout the maneuver. Do not over control with the rudder. Use it to maintain coordination and counter the effects of torque. Throughout the maneuver, maintain coordination, coordinated flight, and definite seat pressures.

5.20. Cloverleaf. The cloverleaf is composed of four identical maneuvers, each begun 90° from the preceding one (figure 5.7). The top part of this maneuver is similar to the recovery from vertical flight. The lower part resembles a split S. This maneuver will help develop your timing, planning, and coordination, using outside references.

5.20.1. Perform the cloverleaf smoothly without rapid roll rates or excessive G forces. If possible, choose an area with section lines for easy reference. To begin the cloverleaf, adjust the throttle to full power and attain the entry airspeed of 130 to 150 knots as the aircraft reaches level flight. The initial part of the maneuver is a straight pullup similar to a loop except for lower G loading.

5.20.2. Pick your reference point 90° from the nose. Start a climb and keep checking this point as you progress through the climb. As the aircraft reaches 60° of pitch, begin a coordinated roll toward the 90° reference point. Allow the nose to continue climbing during the roll so the maneuver is fairly slow and lazy. Your first objective is to climb and roll so the nose passes through the reference point with the aircraft at wings level, inverted, and at a relatively low airspeed. (Don't stare at the airspeed indicator, but check it as you pass through your selected point.)

5.20.3. As the aircraft is brought through the 90° point, keep the wings level and pull through the bottom of the maneuver. Plan the pull to reach level flight with entry airspeed. To avoid excessive Gs at the bottom of the pull, apply more back pressure as soon as the nose track descends below the horizon and hold sufficient back pressure to keep the airspeed from building up too quickly during the initial part of the pullout. You may have to release some back pressure in order to reach entry airspeed. If you let the airspeed build up too fast, you will probably exceed entry airspeed and find yourself pulling high G forces in the pullout. Get the nose tracking early with back pressure. Do it smoothly and avoid the buffet range. Buffet will not hurt the aircraft, but it is poor technique.

5.20.4. Having completed one quarter of the maneuver, again select a point 90° from the nose and repeat the maneuver just described. The cloverleaf is complete after four leaves in the same direction.

5.21. Immelmann. The Immelmann is a half loop followed by a half roll, all flown in the same vertical plane (figure 5.8). To begin the Immelmann, adjust the throttle to full power and select a ground reference as explained in paragraph 5.15.1 for the loop.

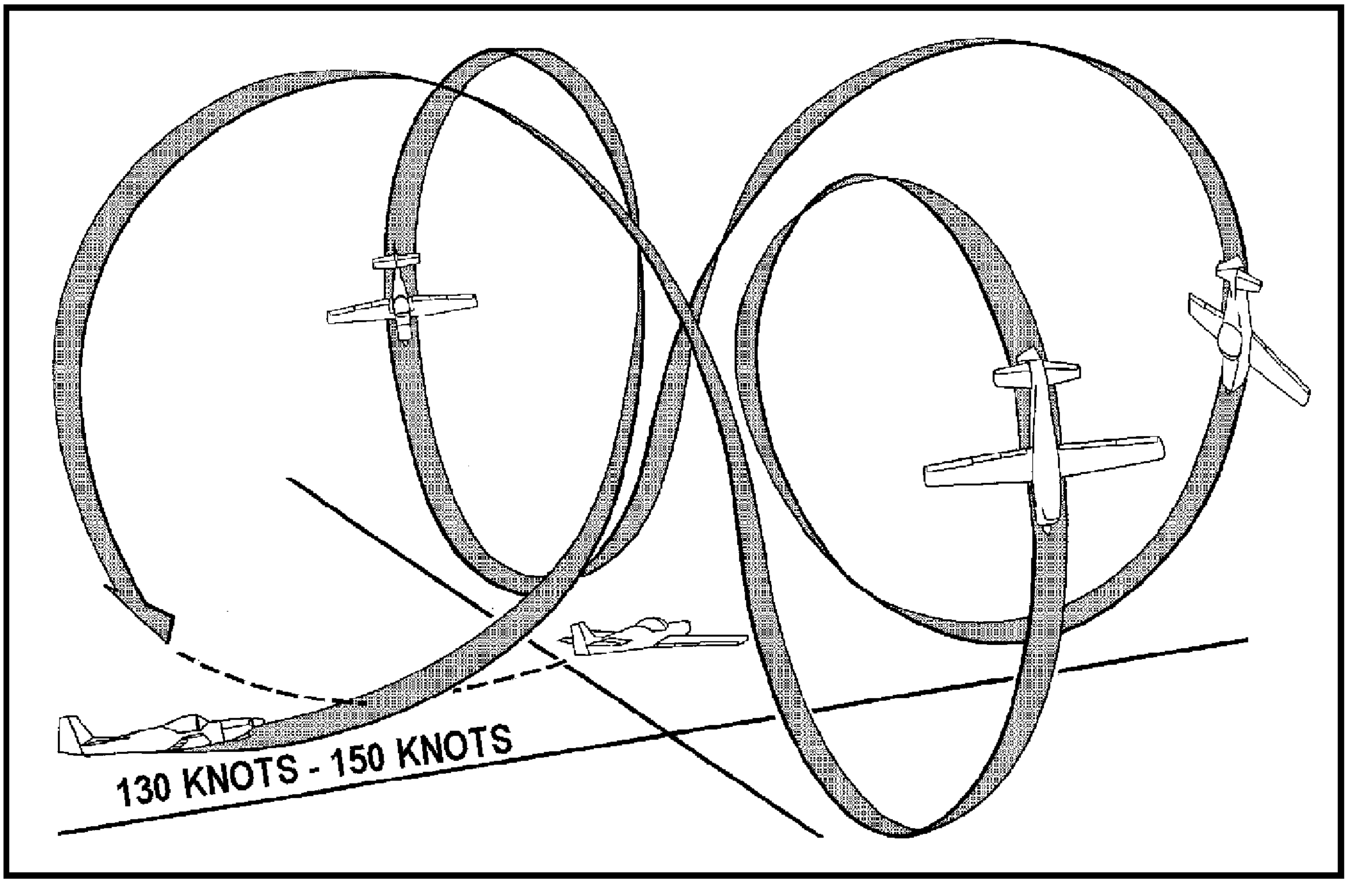

Figure 5.7. Cloverleaf.

5.21.1. Enter a dive to gain airspeed. Then pullup to level flight with the entry airspeed of 140 to 150 knots. Continue nose track by increasing back pressure. Maintain a constant rate of nose track throughout the pullup (initially about four Gs on the accelerometer). Maintain wings level with coordinated flight controls (ailerons and rudder).

5.21.2. The aircraft reaches a point approximately 20° above the horizon inverted, apply aileron in either direction to initiate a roll to level flight. Through the first portion of the roll, apply opposite rudder to applied aileron pressure. Reverse the rudder in the same direction as the applied aileron in the last portion of the roll.

5.21.3. During the first half of the roll, relax some back pressure to keep the nose track in the same vertical plane. Increase this back pressure again as you approach the level- flight attitude because the nose will want to drop as the airspeed decreases. Increase the rudder pressure during the last part of the rollout to hold the nose in the vertical plane. The maneuver is complete after a momentary pause in level flight following the rollout.

5.22. Lazy Eight. A lazy eight is basically a coordination exercise. It is a slow, lazy maneuver where the nose track of the aircraft describes a figure eight lying on its side at the horizon (figure 5.9). The horizon line bisects this figure eight lengthwise. The maneuver includes a 180° change of direction and reversal, requiring a continuous change of pitch and bank.

5.22.1. To execute the lazy eight, you must use constantly changing control pressure. This is due to the changing airspeeds, bank, and pitch attitudes. As an aid in making symmetrical loops, you should select a prominent point on the horizon or a ground reference, such as a section line or road from which you can mentally project an imaginary intersection at the horizon. The more references you use, the easier it is to perform good lazy eights and remain oriented in the area.

5.22.2. Look in the direction of the turn and clear while performing the maneuver. In straight-and-level flight with 130 knots airspeed, select the desired reference point on the horizon. Align the aircraft so the reference point is directly off a wingtip. Blend aileron, rudder, and

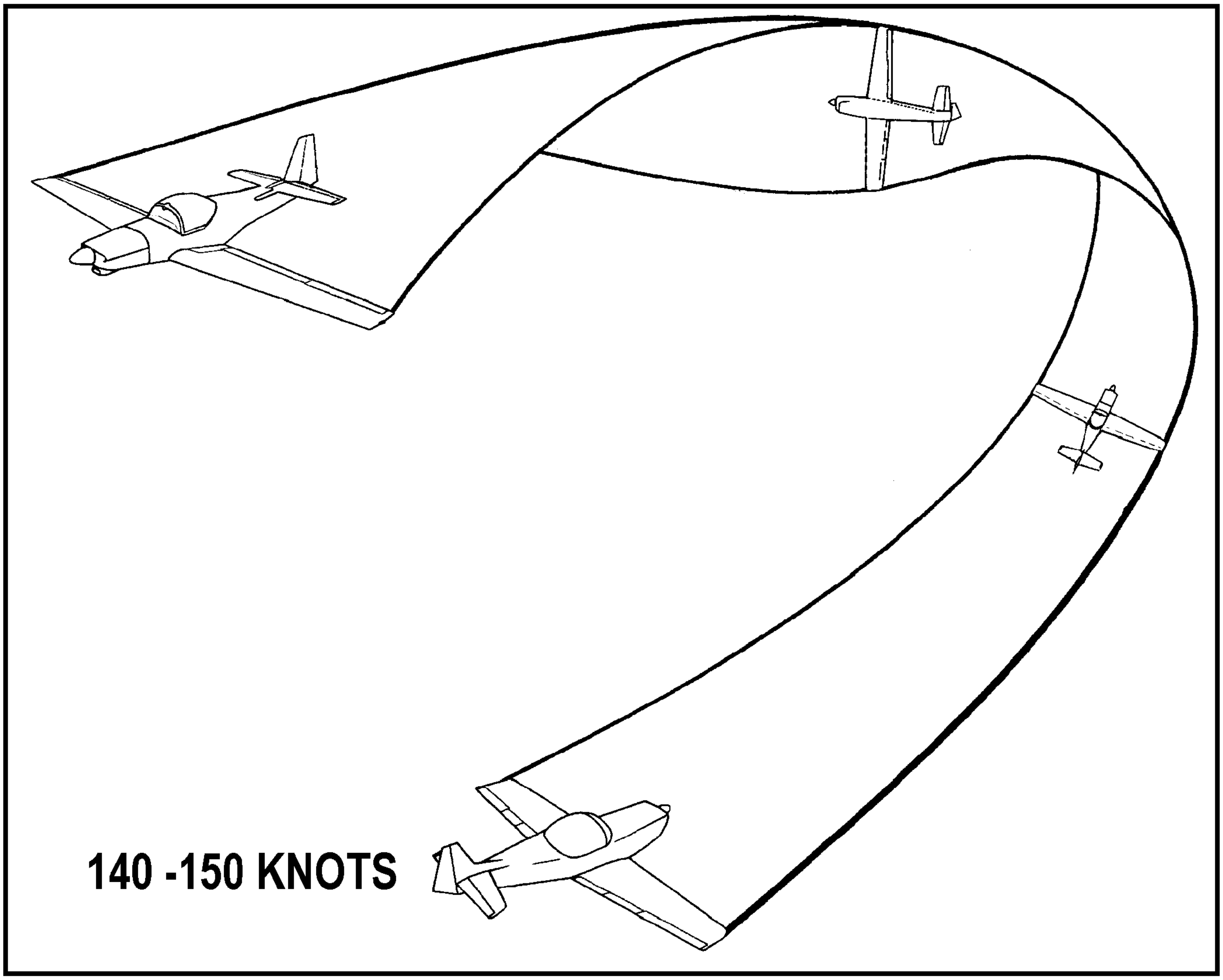

Figure 5.8. Immelmann.

elevator pressures simultaneously to start a gradual climbing turn in the direction of the reference point.

5.22.3. The initial bank is very shallow to prevent turning too fast. As you raise the nose, the airspeed decreases, which increases the rate of turn. Also, as you increase the bank, the rate of turn increases. Time the turn and pullup so the nose reaches the highest point when the aircraft has turned 45° or halfway to the reference point. Use outside references and the attitude indicator to cross-check these pitch-and-bank attitudes.

5.22.4. Do not hold the nose in this attitude, but lower it slowly to the horizon and toward your reference point. Continue to increase your bank to attain 80° to 90° as the nose reaches the horizon. Cross-check outside references and the attitude indicator for bank. The level-flight pitch reference point should reach the horizon at the 90° point. Monitor the progress of the turn by checking outside references.

5.22.5. The airspeed should be the lowest as the nose reaches the horizon (approximately 50 knots below entry airspeed). Do not stop the nose at the horizon, but fly the aircraft into a descending turn so the nose track describes the same size loop below the horizon as it did above the horizon. When the nose track passes through the horizon, begin to decrease the bank gradually. When the aircraft has turned 135°, the nose should have reached its lowest attitude. The bank should diminish during the descending turn at about the same rate as it increased in the climbing turn.

5.22.6. At the 135° point, there is 45° of turn remaining before the aircraft reaches a level-flight attitude. Continue blending sufficient stick and rudder pressure to

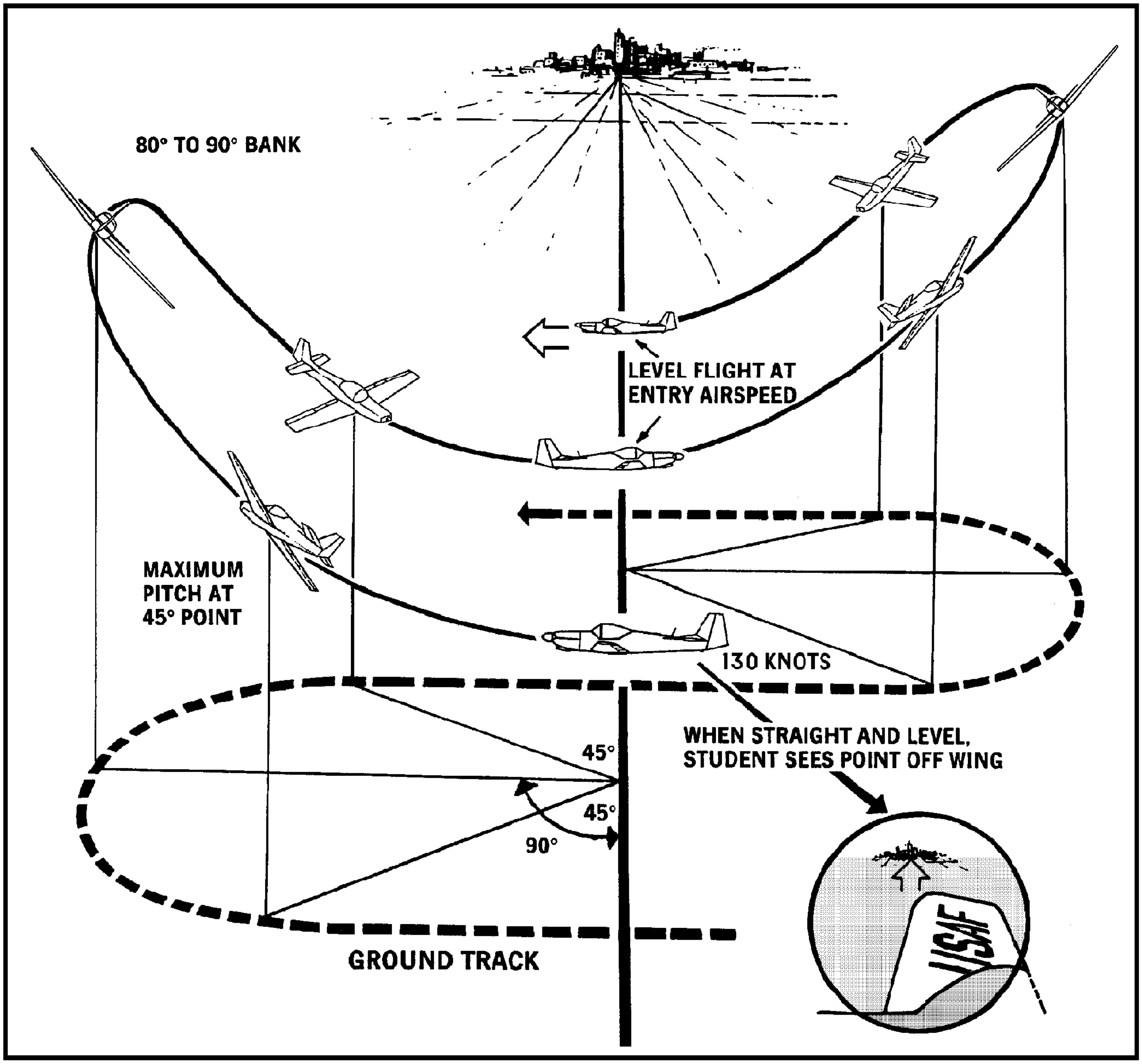

Figure 5.9. Lazy Eight.

simultaneously raise the nose and level the wings. Monitor the progress of the turn by checking your outside reference point. Plan to arrive at the 180° point in level flight with entry airspeed. The wings should level as the aircraft reaches the 180 point. ***(NOTE:*** The beginning and ending of the maneuver are the only times the wings are in the level-flight attitude.)

5.22.7. Having completed half the eight, the opposite wing is now toward the reference point and the nose at the 180° point with entry airspeed. Do not hesitate in straight-and-level flight, but begin another climbing turn in the direction of the reference point. This turn is opposite to the one used at the start of the maneuver. Fly the second 180° turn like the first.

5.22.8. Complete the maneuver with the aircraft headed in the original direction. Complete the maneuver in a slow, smooth, lazy manner without hesitation and with constantly changing control pressures and flight attitudes. Try to use outside references to fly a precise nose track that results in a symmetrical maneuver.

5.23. Cuban Eight. Each half of this maneuver is a slightly modified combination of the loop and the Immelmann. It is approximately the first two thirds of a

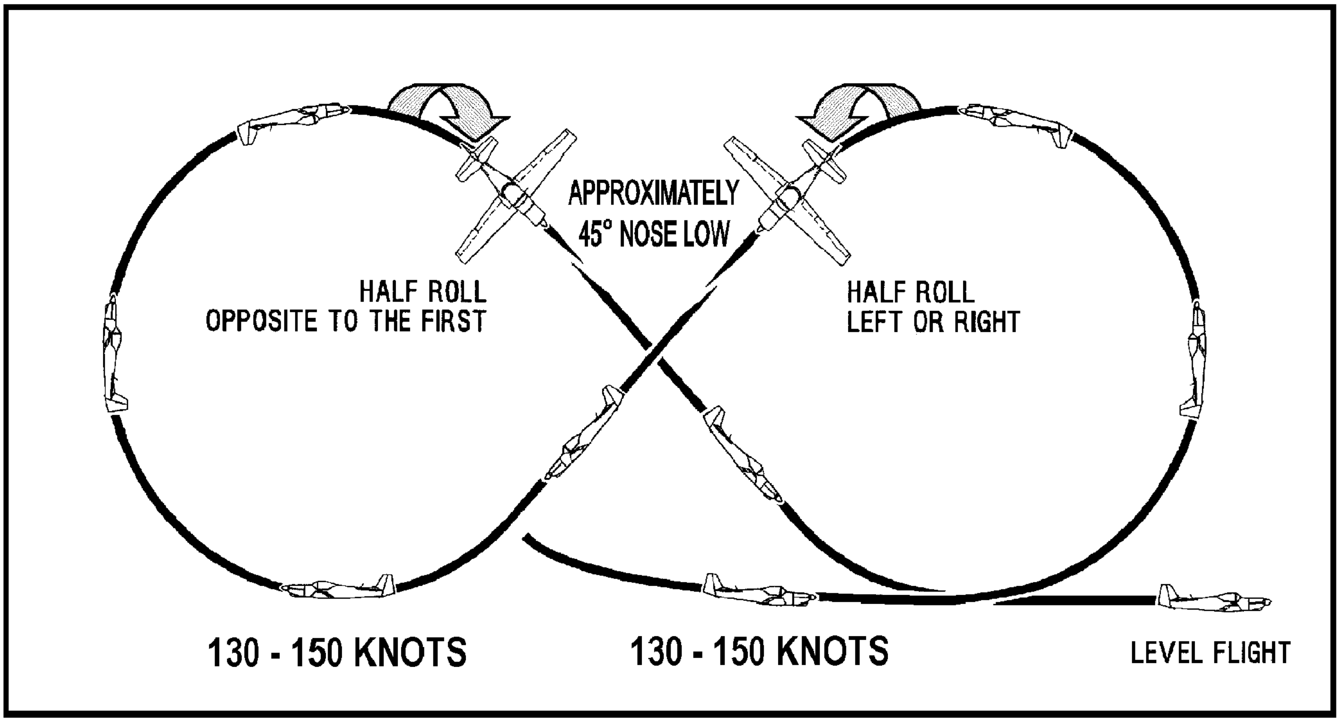

Figure 5.10. Cuban Eight.

loop followed by a half roll. It is then repeated in the opposite direction (figure 5.10).

5.23.1. Adjust the throttle to full power and begin the maneuver by making a normal loop entry of 130 to 150 knots. Proceed over the top. After passing through inverted level flight, relax back pressure approaching 45° below the horizon and execute a half roll in either direction. Use rudder pressure as in the Immelmann to hold the aircraft on the desired heading. Release the elevator pressure to keep the nose track in the same vertical plane.

5.23.2. After completing the half roll, plan your pullup to attain 130 to 150 knots when passing through level flight. Continue the pullup into another loop entry. The second half of the Cuban eight is identical to the first except the roll is in the opposite direction. The maneuver is complete when you attain level flight at entry airspeed.

Section D--Spins

5.24. Spin Training. A spin is an autorotation caused by the combination of an aggravated stall and yaw forces. The aircraft describes a corkscrew path in a downward direction. Although both wings are stalled, one wing has more lift than the other. Gravity forces the aircraft down, rolling and yawing in a spiral path. Spin training will increase your confidence in the aircraft and improve your ability to orient yourself in any attitude.

5.24.1. Two conditions are necessary for the aircraft to spin: stall and yaw. Therefore, any time the aircraft stalls, one of the conditions necessary for a spin exists. If you displace the rudder from neutral during a stall, rotation will result. An important thing to remember throughout your training is that if you hold the controls neutral and don't allow the aircraft to stall, it will not enter a spin or aggravated condition, regardless of airspeed.

5.24.2. The aircraft gives sufficient warning of a spin. It is very easy to recognize a stall and an approach to a spin. Your instructor will emphasize the conditions that could result in a spin and give you concentrated practice in spin prevention.

5.25. Intentional Spin Entry:

5.25.1. Before entering any intentional spin, do the prespin checks and adhere to the spin restrictions in AETCR 11-205. Use power as required during the initial part of the pullup for spin entry. However, if you use any power setting above idle during the pullup, retard the power to idle before or at the first stall indication. Although you can enter the spin from level flight, the preferred method is to enter from a nose-high pitch attitude (10° - 50°). Entering from a nose-high attitude will assist in minimizing altitude loss prior to entering the spin.

5.25.2. At the first stall indication, slowly and smoothly apply back stick and apply rudder in the desired direction of the spin. When the aircraft begins to stall, move the stick at a rate that will maintain a constant pitch attitude until the stick is all the way back. Apply rudder at a rate that ensures full rudder occurs simultaneously with full aft stick. Make sure you use full travel of the stick and rudder and hold the controls firmly against the stops with ailerons neutral.

5.25.3. As the aircraft becomes fully stalled, the aircraft will pitch up slightly and roll rapidly in the direction of the applied rudder. The aircraft may become inverted during the first turn and the spin will progressively stabilize. During the incipient stage, the nose may oscillate above and below the horizon, with the airspeed and the rate of rotation fluctuating. As the spin develops, these characteristics will change. You will learn to recognize a developed spin through demonstration, practice, and knowledge of spins. Normally, the following characteristics will help you recognize a fully developed spin: (1) the nose remains below the horizon, but not necessarily at a constant pitch attitude; (2) the rate of rotation is almost constant; and (3) the airspeed oscillates slightly (usually below 80 knots).

5.25.4. From a developed spin, the aircraft progresses into a stabilized spin if you hold the controls fully deflected. There is not a definite number of turns, pitch attitude, or airspeed to describe a stabilized spin. A stabilized spin is normally characterized by a steady airspeed, constant rate of rotation, and constant pitch attitude (approximately 40° to 45° nose low). You will lose approximately 300 feet per turn in a stabilized spin, and the duration of one turn is approximately 2 seconds (figure 5.11).

5.26. Normal Spin Recovery:

5.26.1. Enter an intentional spin. As soon as the aircraft progresses into a fully developed spin, proceed with the spin recovery procedures. Abrupt control inputs are not necessary. Positive inputs correctly applied will be sufficient to effect recovery.

5.26.2. Physically recheck the throttle is in idle.

5.26.3. Check the control stick fully aft and the ailerons neutral. Hold full spin entry rudder until you apply recovery rudder.

5.26.4. Determine the direction of rotation, using the turn needle and outside references. Immediately after determining the direction of rotation, apply full rudder opposite the direction of the spin (opposite the turn needle) and hold. Do not wait for prominent landmarks before applying recovery rudder.

5.26.5. After applying recovery rudder, pause approximately 1 second; then smoothly move the stick forward while maintaining the ailerons in the neutral position. As the nose pitches down near the vertical, continue to hold rudder until spinning has stopped. Do not allow the stick to move aft of neutral until recovery is effected. After the rotation is definitely stopped, neutralize the rudder and recover from the ensuing dive.

5.26.6. Normally, full anti spin rudder and a smooth application of the control stick forward of neutral are enough to effect recovery. However, if the center of gravity is at the rear limit, be prepared to move the control stick fully forward.

5.27. Spin Prevention. This maneuver is designed to teach you to recognize and recover from a developing spin condition. It will also show you what may occur when you delay stall recovery or spin prevention procedures. Your IP will have you initiate spin prevention procedures at varying degrees of rotation, but before stabilization.

5.27.1. Perform an intentional spin entry. Before stabilization, initiate the spin prevention by simultaneously applying progressive forward stick and rudder opposite the direction of the spin (leaving the throttle set). Use aileron to level the wings only after the stall is broken. If you recover in the incipient stage, you may end up in an extreme nose-high or nose-low attitude. Use the appropriate nose-high or nose-low recovery procedure to get the aircraft back to level flight.

5.27.2. The degree of control deflection necessary to prevent the spin depends on how far the spin has developed. In some cases, full control deflection may be required. Do not use abrupt control movements, but use the controls smoothly and positively. As prevention controls are applied, the rate of rotation may increase until they become effective. If full prevention controls are applied and the nose remains below the horizon with rotation stabilized at an increased rate, the spin has developed too far for prevention controls to be effective and a spin recovery is necessary. Spin prevention procedures are most effective when employed at the early stages of spin development. Stall and yaw conditions are easily controlled, rotation is slow, and the recovery is almost instantaneous.

5.28. Inadvertent Spins. It is important to realize that

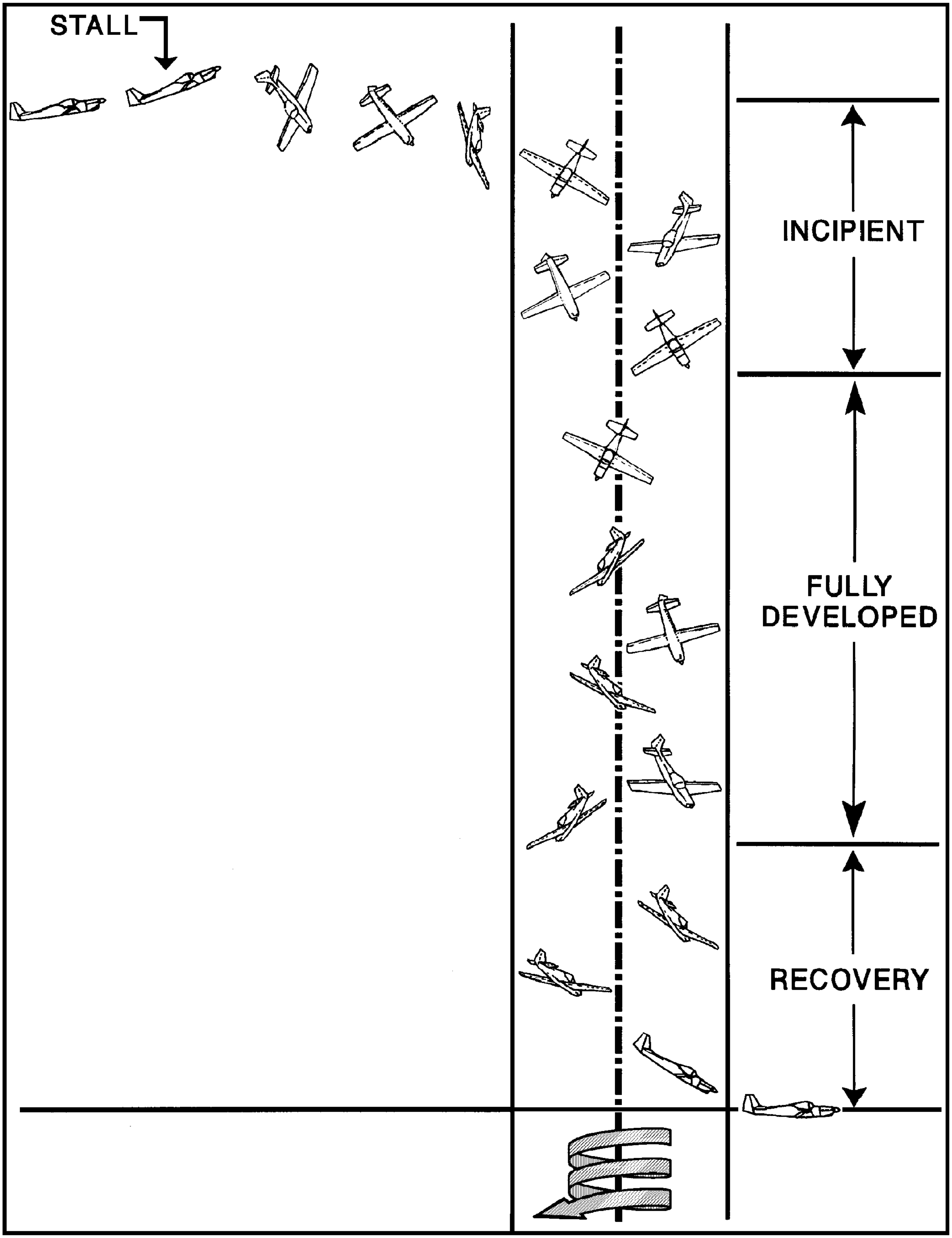

Figure 5.11. Three Stages of a Spin.

inadvertent spin entries are often more disorienting and oscillatory than planned entries. Also, the parameters for rotation rates, descent rates, and pitch attitudes apply only to stabilized normal erect spins (paragraphs 5.25.3 and 5.25.4). Depending on control position, inadvertent spins may be accelerated and these parameters can vary. However, the spin prevention and spin recovery procedures are extremely reliable. Spin prevention will fail only if the spin is excessively accelerated. The spin recovery procedure is always effective if you perform it properly.

5.28.1. If you suspect an inadvertent spin, immediately employ the spin prevention. Control pressures may differ from those experienced during practice spin preventions because of the position of elevator trim or aircraft configuration. Inadvertent spin entries can result in severe pilot disorientation. In these situations, immediately begin spin recovery procedures. Under these conditions, using the spin recovery procedures will ensure a positive recovery and may be more effective than a spin prevention.

5.28.2. If a landing configuration spin is inadvertently entered, immediately apply spin prevention procedures. (After applying full prevention controls, if the nose remains below the horizon and the rotation stabilizes at an increased rate, execute the spin recovery. Retract the flaps as soon as possible after rotation stops to prevent excessive structural loads.

5.29. Glides and Gliding Turns. You practice glides and gliding turns to help you establish and maintain the proper glide airspeed and attitude and to develop your ability to judge gliding distance. Practicing glides and gliding turns will also help you develop those skills necessary to accomplish a successful forced landing.

5.29.1. Before entering the glide, clear the area you will be descending into. For prolonged glides, you may also want to use bank as necessary during the glide to clear below your aircraft. You will accomplish glides straight ahead or using shallow turns, and at different flap settings. During the glide, it will be necessary to clear the engine approximately every 500 feet by advancing the throttle a minimum of 300 RPM.

5.29.2. Glide speed depends on the flap setting. A glide with flaps allows you to descend at a steeper angle and faster rate without increasing airspeed. Use the following flap settings and associated airspeeds when accomplishing glides: flaps up - 80 KIAS; 18° flaps - 75 KIAS; 40° flaps - 70 KIAS.

5.29.3. The entry into a glide is made from straight-and-level flight by reducing the throttle to idle. As the airspeed decreases, adjust the pitch attitude as necessary to maintain level flight. Below the applicable flap-limiting airspeed, lower the flaps if desired. As the airspeed approaches the glide speed, lower the nose to maintain glide speed and trim to relieve stick pressures. Adjust the pitch attitude and retrim as necessary throughout the descent to maintain the glide speed.

5.29.4. To level off from a glide, begin by raising the nose to a level flight attitude approximately 20 feet before reaching the desired altitude while simultaneously advancing the throttle to full power. Check the flaps up when the airspeed is above 80 KIAS. The maneuver is complete when you have returned to level cruise flight.

5.30. Slip. A slip allows you to lose altitude rapidly and could be used during a forced landing if you find yourself high on your intended glidepath. The aircraft is purposely placed into a slip using rudder and opposite aileron as necessary to hold the aircraft on the desired ground track. This creates excess drag by exposing more of the fuselage to the slipstream. A slip may be practiced during a glide in the area or as a separate maneuver. For example, establish a glide in the area (40 or 0 flap), simulate you are high on glidepath. Begin a slip by smoothly applying the desired amount of rudder and then using ailerons as necessary to maintain ground track. Your instructor will demonstrate the amount of rudder to use. The aircraft is now flying sideways into the wind, descending rapidly. Use caution during side slips to keep the nose lowered to maintain your glidespeed. Side slips may result in airspeed errors. Notice the difference in VSI during the slip and during the glide without the slip. Once desired glidepath is reached, release the rudder and aileron and reestablish the glide. Level off as described in paragraph 5.29.4.

Chapter 6

TRAFFIC PATTERN AND LANDING

6.1. General Guidelines. You will do all of your flying in the T-3 at the home base (and auxiliary fields for the 557th Flying Training Squadron). Because of the number of aircraft operating at these locations, every pilot must conform to established procedures and a standardized traffic pattern. The runway is the primary reference in the traffic pattern. Your IP will provide ground references at these fields to fly the patterns for existing

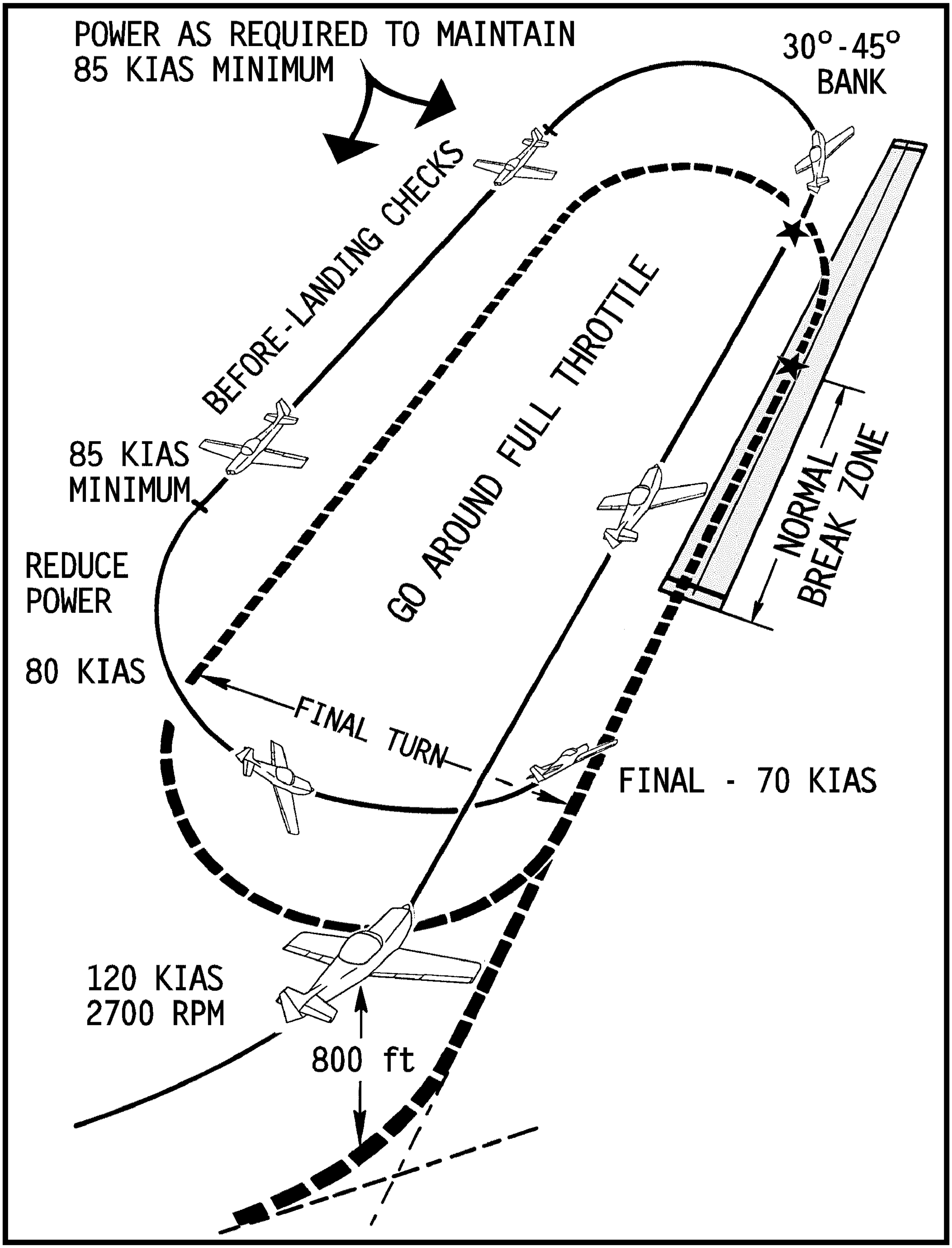

Figure 6.1. Normal Traffic Pattern.

conditions. You should learn how to adjust for winds and use universal references which will work at any field. Use these references as aids in developing the judgment required to accurately estimate distances and glidepath. The radio calls in this chapter are standard calls in the undergraduate flying training (UFT) environment. When not flying in this environment, use local procedures or standard Air Force terminology, as appropriate.

6.2. Letdown. The letdown is primarily used to descend to traffic pattern altitude or the altitude specified for recovery operations. Plan the letdown to enter the traffic pattern or to comply with local directives. Prior to starting the letdown, complete the descent check and ensure you have clearance to depart your assigned area. To begin a letdown, simultaneously lower the nose and adjust the power as necessary. The airspeed in the letdown is normally 120 to 140 KIAS or as specified in local directives (within safe limits). This allows you to concentrate on the outside references and clearing during the descent. Using clearing turns is an excellent technique to aid clearing during a VMC letdown. This also helps control descent rates. Your IP will demonstrate the proper letdown techniques. A good lead point will allow you to accomplish a smooth level off at the desired altitude. One technique for determining a lead point is to use approximately 20 feet above the level-off altitude. As you approach the level-off altitude, gradually bring the nose of the aircraft to the level-flight attitude, and adjust the power as necessary, and trim the aircraft.

6.3. Standard Overhead Pattern. The 360° standard overhead pattern is used to safely and properly handle a maximum number of aircraft with minimum congestion (figure 6.1). You will adjust the pattern for existing wind conditions.

6.3.1. **Before Traffic Entry**. Before entering the traffic pattern, accomplish all applicable checklists and determine the landing direction by monitoring the appropriate radio frequency and watching other aircraft. If you are not sure of the direction of traffic, obtain landing instructions from the RSU, tower, or other controlling agencies. When the RSU or tower broadcasts runway winds, keep this information in mind. This information directly affects how you fly the traffic pattern. Local instructions define the traffic pattern entry procedures. You must adequately clear while descending to enter traffic.

6.3.2. **Initial Approach**. When turning onto initial, plan the rollout so you are aligned with the runway center line or as directed. The pattern altitude is normally 800 feet above the terrain (or as required by local instructions) and airspeed on initial is 120 KIAS. Call initial to the controlling agency as directed, and state your fuel remaining if you plan a full stop. The break is normally performed between the approach end and halfway down the runway. The exact point of the break is affected by existing wind conditions and traffic saturation. To avoid a traffic conflict on final, do not initiate a break when a T-3 is on a straight-in approach between 4 and 2 miles. To accomplish the break, smoothly roll into a 30° to 45° bank turn. The angle of bank and amount of back pressure will vary according to wind conditions. Smoothly retard the throttle during the break to slow the aircraft to a minimum of 85 KIAS. Continue the level turn and roll out on the downwind with the necessary drift correction to maintain a flightpath parallel to the runway.

6.3.3. **Downwind Leg**. As you roll out on the downwind, adjust the throttle to approximately 15 to 18 inches of manifold pressure, initiate the before-landing check, and select 18° of flaps. Use power as necessary to maintain airspeed and altitude. Maintain minimum airspeed of 85 KIAS on the downwind leg. As airspeed decreases you will have to retrim the aircraft and increase the pitch attitude to maintain level flight.

6.3.3.1. At or approaching the point where you would initiate the final turn (commonly referred to as the perch), select 40° of flaps. You will fly normal patterns using full flaps.

6.3.3.2. Do not start the final turn in the following cases: (1) if there is another aircraft in the final turn and not in sight, (2) if there is a straight- in inside of 2 miles and not in sight, or (3) if you cannot maintain normal pattern size and safe spacing. If you do not have the aircraft in front of you in sight, break out from the downwind leg using local procedures.

6.3.4. **Final Turn**. The final turn begins as you initiate the turn from the downwind leg. The turn is complete when you level the wings on final approach. Plan to roll out on a 1/2 to 3/4 mile final approach and a 3 to 4 degree glidepath. This equates to approximately 300 feet above the terrain. Normal patterns should favor a 1/2 mile, 4 degree glidepath. No-flap patterns should favor a 3/4 mile, 3 degree glidepath. Adjust your pitch during the final turn to roll out on a good glidepath on final.

6.3.4.1. Adjust the turn point for the existing wind condition. If a strong tailwind exists on downwind, remember, this will blow the aircraft from the approach end and a long final will result if the turn is started at the normal position. Before beginning the final turn, it is helpful to pick a specific rollout point on the ground. Begin your turn to final to arrive wings level on final over this point.

6.3.4.2. Starting the final turn, simultaneously lower the nose of the aircraft and roll into approximately 30° of bank. When the bank and pitch are set, the horizon should be in the upper one-third of the windscreen.

6.3.4.3. After starting the final turn, slow to 80 KIAS and trim the aircraft. A power setting of approximately 10 to 12 inches of manifold pressure is normally adequate to maintain final turn airspeed. Make a final turn call to the controlling agency as soon as safely possible after confirming your configuration.

6.3.4.4. In the final turn, divide your attention between the airspeed indicator, rollout point, and runway. Visualize and project your descent angle around the final turn, over the rollout point, and down the final approach. The descent angle, projected to the ground, will be to a point just short of the intended touchdown point. Because of crosswinds, it may be necessary to vary the bank angle in the final turn. Plan the pattern for approximately 30° of bank and do not exceed a maximum bank of 45°. Remember, the stall speed of the aircraft increases as bank angle increases. If you have any doubt about the safety of continuing the approach, go around.

6.3.5. **Final Approach**. The final approach begins when you level the wings after the final turn. Check your spacing with the aircraft ahead of you on final approach. If it appears you will not land with proper spacing, anticipate the need to go around and make a timely decision.

6.3.5.1. After rolling out on final and aligned with the runway, you have two objectives: The first is to maintain runway alignment; the other is to maintain a smooth, constant glidepath to roundout and touchdown.

6.3.5.2. After rolling out on final, adjust the power to slow to final approach airspeed (70 KIAS with 40° flaps). Because you are slowing from a higher final turn airspeed, you will need to adjust the pitch and trim accordingly. Consequently, you must raise the nose of the aircraft to establish the correct glidepath. A good final approach pitch reference is the runway threshold halfway up the windscreen.

6.3.5.3. On final approach, as in the final turn, the wind will affect the aircraft, so the flightpath must coincide with the desired ground track. Because there is almost always a wind condition less than optimum (blowing straight down the runway), you may need special techniques to maintain runway alignment. There are two ways to do this, the wing-low method and the crab method. In the T-3, use the crab method as you roll out on final, then transition to the wing-low method. The normal inclination is to automatically roll out of the final turn with a crab into the wind (figure 6.2).

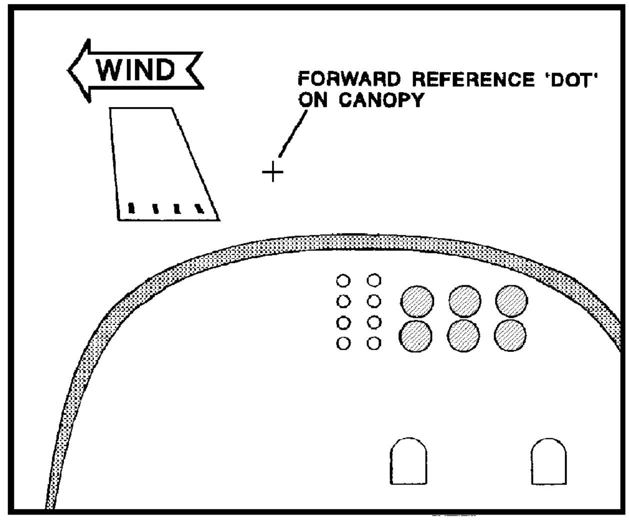

Figure 6.2. Crab Into the Wind.

6.3.5.4. Rolling out on final with a crab into the wind indicates how much control deflection you will need for transition to the wing-low method. Set up the wing-low crosswind approach shown in figure 6.3.

6.3.5.5. The proper method for using crosswind controls is to first apply sufficient rudder deflection to align the longitudinal axis of the aircraft with the runway. Then use ailerons as necessary to keep the flightpath aligned with the runway. Maintain airspeed by increasing the power to compensate for the increased drag caused by crosswind controls.

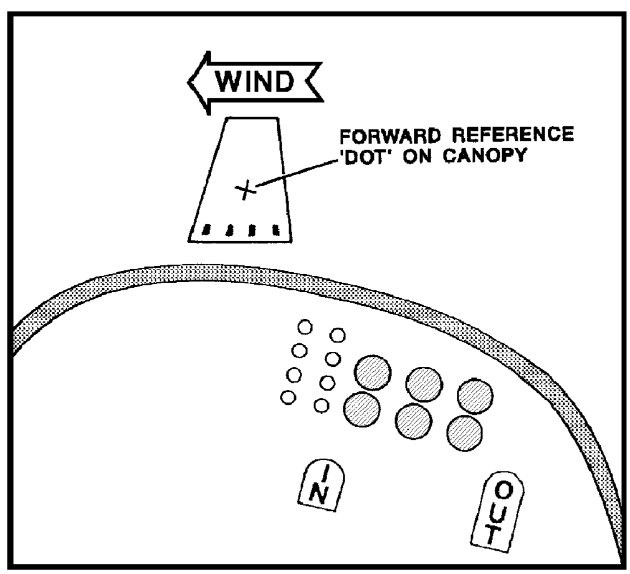

Figure 6.3. Wing-Low Crosswind Approach.

6.3.5.6. The second and most difficult objective is visualizing a constant glidepath to the roundout and touchdown. In the normal landing configuration (full flaps), the T-3 flight attitude is such that the aircraft is aimed (putting the level flight horizon reference) at a position (aim point) short of the intended touchdown point (figure 6.4). You should aim short of the intended touchdown point because of the delay during the roundout. Plan to touch down on the center line within the first 1,000 feet of the runway. Your main objective is to strive for a touchdown with the proper landing attitude at a point on the runway that provides an adequate safety margin against landing short, yet allows the aircraft to easily stop within the available runway. In determining your aim point, consider all factors, such as wind, runway length, aircraft weight, and flap setting.

6.3.5.7. Frequently check the airspeed on final approach. Approaching the threshold, smoothly reduce the power and begin the roundout by smoothly increasing back pressure on the control stick.

6.3.5.8. If you will be landing in strong or gusty wind conditions (approaching the maximum crosswind limit) you should consider flying a normal approach and landing (full flaps) and adding 5 KIAS to normal final approach airspeed.

6.4. Normal Landings. So you may better understand the factors affecting your judgment and pilot technique, the landing is divided into three phases: roundout, touchdown, and landing roll.

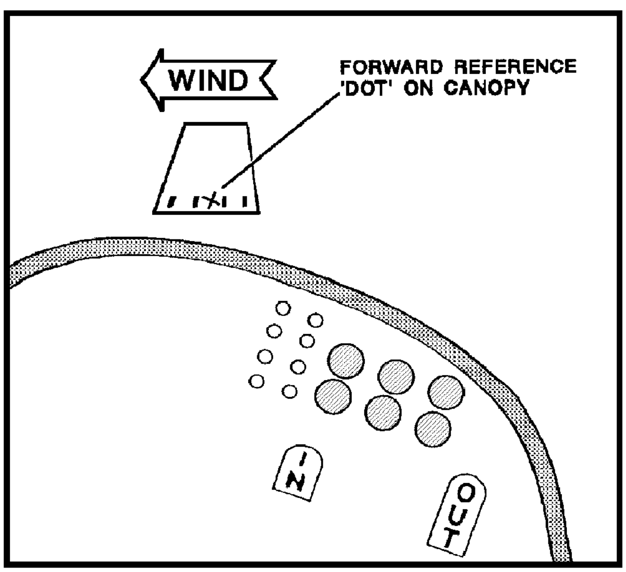

Figure 6.4. Aiming Short of Touchdown Point.

6.4.1. **Roundout**. During the roundout, decrease the rate of descent as you approach touchdown. Smoothly continue back pressure, increasing the pitch attitude until you reach the proper landing attitude. During the roundout, the airspeed will decrease, causing the aircraft to settle gently onto the runway. Retard the throttle to idle at or before touchdown.

6.4.1.1. The height of the roundout will vary, depending on your rate of descent. Make the roundout proportionate to your rate of descent. You will need to start the roundout sooner if your descent rate is slightly higher than normal. The opposite is true if you have a slower descent rate. Your IP will show you the height to start a roundout with different rates of descent.

6.4.1.2. Throughout the roundout, be aware of the effects of crosswinds. If crosswinds exist, you must use crosswind controls throughout the roundout. As the airspeed decreases to just above the stall, you will need additional aileron and rudder deflection. If you deflect the control surfaces out of their normal streamlined position, drag will increase and the airspeed will dissipate much faster. Use caution during gusty wind conditions for rapidly changing wind direction and velocity. Use timely control inputs to maintain directional control.

6.4.1.3. Use power during the roundout to compensate for errors in judgment. Any time the controls feel mushy or you feel approach-to-stall indications, apply power and execute a go-around. This will cushion any ensuing touchdown. If it appears you are going to land excessively long, do not hesitate to go around.

6.4.2. **Touchdown.** The touchdown is the gentle settling of the aircraft onto the runway in the landing attitude. Continue to hold any crosswind control deflection during the roundout. If you do not, the aircraft will crab into the wind and you will touch down in a crab. When using crosswind controls, expect one main gear to touch down before the other. If crosswinds are not significant, maintain the landing attitude after touchdown. This will require increasing backstick pressure as airspeed dissipates. Lower the nose wheel to the runway while there is still sufficient elevator control. Avoid lowering the nose wheel abruptly. If the nose wheel contacts the runway on touchdown, leave it there. Attempts to lift it off at high speeds may cause the aircraft to become airborne with a dangerously high AOA. If you used power during the roundout to decrease the rate of descent or prevent a stall, retard the throttle to idle upon touchdown so the aircraft will stay on the ground. During the flare and touchdown, do not lose sight of the horizon or have a pitch attitude higher than the takeoff attitude, or you may drag the tail.

6.4.3. **Landing Roll**. After lowering the nose wheel to the runway, maintain directional control with rudder and (or) brakes. Do not relax! The aircraft is still exposed to considerable airflow in conjunction with strong or gusty wind conditions, requiring the appropriate use of flight controls during the landing roll.

6.4.3.1. Familiarize yourself with the factors influencing the controllability of the aircraft after the landing. Some of these factors are the center of gravity, strong crosswinds, a low strut, and a slippery runway. As the aircraft slows down, the flight controls lose their effectiveness, thus increasing the effect of the crosswind. The T-3 has more surface area behind the main landing gear than in front. After the aircraft is on the ground, the main landing gear is the fulcrum point and the impact of the crosswind on the empennage will cause the airplane to act as a weather vane and turn into the wind. You can see how important it is to use rudder and (or) brakes to maintain directional control during the landing roll.

6.4.3.2. You must also use aileron to prevent the crosswind from lifting the upwind wing. If you use too much aileron, the other wing will start to rise. By the time the rudder effectiveness is lost, you may need full aileron deflection to keep the wings level.

6.4.3.3. During any ground roll, you can change direction by applying pressure on a single brake or uneven pressures on both brakes. You must use caution when applying the brakes to avoid over controlling. To use the brakes, slide your feet up on the rudder pedals so you can apply toe pressure to the top of the pedals. If you are holding rudder pressure and need to apply the brakes, try holding the rudder pedals in position as you slide your feet up. The brakes work independently of rudder pedal position. For instance, it is possible to hold right rudder and left brake, although such a requirement is not likely.

6.4.3.4. When you're ready to use the brakes to slow the aircraft, apply smooth and continuous pressure until the aircraft slows to taxi speed. Do not brake to a near halt and then taxi with power for the remainder of the landing roll. Nosewheel steering is normally not necessary until the aircraft slows to normal taxi speed.

6.4.3.5. When ready to exit the runway, clear behind you and turn off the runway. Do not complete any checklist items until you are clear of the runway. Concentrate on maintaining directional control and slowing the aircraft to a safe taxi speed.

6.5. Touch-and-Go Landings. For touch-and-go landings, smoothly apply power as soon as the main gear touches down. Maintain directional control with the rudder. Keep in mind rudder to counter torque. As you advance the throttle, lower the nose slightly from the landing attitude to the takeoff attitude while holding the nosewheel off the runway. Coordinate pitch and power to keep the aircraft from becoming prematurely airborne at low airspeed. After becoming safely airborne, perform the after-takeoff checklist.

6.5.1. If it appears you are going to land long, advance the power and go around. Although the T-3 accelerates rapidly, the aircraft may continue to settle and touch down. In this event, do not try to hold the aircraft off the runway in a nose-high attitude. Maintain a landing attitude and allow a normal touchdown.

6.5.2. If you have trimmed the aircraft properly on final approach, the noseup trim will tend to fly the aircraft off as soon as you attain flying speed. You may have to use forward stick pressure to compensate for the tendency of the nose to pitch up, but the force is not strong. Do not retrim the elevator during the ground roll.

6.6. No-Flap Pattern and Landing. The procedures for the entry, initial, and break are the same as in the normal overhead pattern.

6.6.1. If factors dictate a no-flap landing, adjust the power to maintain 85 KIAS on downwind. Remember to adjust the pattern for existing wind conditions. At the perch, adjust the power and pitch to start the final turn. Maintain a final turn airspeed of 85 KIAS, keeping in mind you will need a low power setting since you have drastically reduced the drag. As you look out the front of the aircraft, the horizon should bisect the canopy, showing about one-half ground and one-half sky. The final turn may appear to follow a shallow descent angle compared to a 40° flap approach because of the higher pitch attitude, but in reality the flightpath will remain the same.

6.6.2. As you roll out on final, adjust the throttle to maintain 75 KIAS on final approach. Because of the higher pitch attitude with the flaps retracted, the runway is more difficult to see over the nose of the aircraft. As a general rule, put the runway threshold barely in view over the aircraft nose. Remember, the objective is to fly a consistent final approach so the flare over the runway is the same for every landing, so work hard to maintain final approach airspeed.

6.6.3. As the aircraft approaches the threshold, anticipate the need for a power reduction. Every time you adjust your power and slow to a new speed, remember to trim the aircraft. Make small corrections to speed and glidepath while on final. If you maintain speed on final, your rate of descent should be approximately 500 feet per minute (fpm).

6.6.4. Crossing the threshold, smoothly reduce the power to idle. The aircraft will float longer and have a slightly more nose-high landing attitude compared to a landing with flaps. Use caution as you round out and touch down during no-flap landings. If you have an excessive flare, you might land on the aircraft's tail skid.

6.7. Go-Around. Sometimes during traffic pattern and landing practice, you will find yourself in a poor position to make a safe landing. In this case, discontinue your approach for reasons of safety and execute a go-around. Although you can abort an approach at any point, execute a go-around from the final approach or roundout. The sooner you recognize a poor landing condition and start a go-around, the safer you will be. Do not wait until the last second to make a decision and do not try to salvage a bad approach. Ideally, the runway supervisor should not have to direct a go-around. You should execute a go-around when you notice a dangerous condition. Examples of dangerous conditions are low final turns, overshot final turns, wake turbulence, distracted attention, and insufficient spacing from other aircraft.

6.7.1. **Final Approach or Landing Go-Around**. Advance the throttle to full power to execute a go-around from the final approach or landing phase. Use rudder as necessary to maintain coordinated flight. When you are sure you will remain airborne and have reached 80 KIAS minimum, retract the flaps (if applicable) and continue normal takeoff procedures. As the flaps retract, you may need to raise the nose slightly to offset any tendency of the aircraft to sink. If there is traffic ahead of you on final or on the runway, clear the runway during the offset (*Exception:* It is not necessary to clear the runway if the aircraft on the runway in front of you is a full stop.) If you must clear the runway, be at a safe altitude, use the minimum practical bank angle, and clear in the direction of the turn. Displace yourself a sufficient distance from the runway so you can adequately monitor aircraft on the runway or takeoff leg. When you are well clear of the runway, execute another turn to parallel the runway. The direction of these clearing turns will depend on local procedures at your base. Allow the aircraft to accelerate to 90 KIAS (or as specified in local procedures) and climb or descend to 400 feet above the terrain during the go-around until you are beyond the departure end of the runway or as directed locally.

6.7.2. **Final Turn Go-Around**. Normally you perform the procedures for a go- around from the final turn after rolling out on final approach. In the final turn, use power as necessary to maintain a safe airspeed. Monitor your airspeed closely to avoid overspeeding the flaps. If you require a go-around to the inside of the normal pattern, use extreme caution. Attempts to tighten a turn without proper consideration for power and airspeed could lead to a stall. Never break out from the final turn. Your IP will cover techniques for this type of go-around.

6.7.3. **Straight Through Initial**. If it is necessary to discontinue a pattern before the break, continue straight through on initial at 800 feet above the ground and 120 KIAS or as directed locally. At the departure end of the runway or as directed locally, turn to crosswind. Clear below for aircraft on the takeoff leg or pulling up into closed traffic and for aircraft already established on closed downwind.

6.7.4. **Breakouts From an Overhead Pattern**. If it is necessary to discontinue an overhead pattern, follow the local procedures for leaving traffic. Do not wait to be directed to break out if you see a dangerous situation developing. Use your initiative and judgment and exit traffic immediately. If you are directed to leave traffic, follow instructions without hesitation. Use caution when breaking out from the downwind leg because your airspeed will be slow and you may have the flaps extended.

6.8. Straight-in Approach. Use the straight-in approach when conditions require a landing with minimum maneuvering. Examples of these conditions are structural damage or an unlocked canopy. Your IP will demonstrate the straight-in approach and have you practice it with and without flaps as follows:

6.8.1. Notify the RSU or tower as directed locally and obtain permission for the approach.

6.8.2. Arrive at the designated entry point at 800 feet above the terrain if not otherwise specified.

6.8.3. Before you are 2 miles from the runway, complete the Before-Landing Check. Maintain airspeed at or above the final turn speed for the desired flap setting until aligned with the runway. Once aligned with the runway, you may begin to slow to the appropriate final approach airspeed.

6.8.4. During a normal straight-in approach, start the descent to establish a normal glidepath. Continue as you would on a normal final approach.

6.8.5. During a no-flap straight-in approach, reduce power as necessary and start the descent to establish a no-flap glidepath. Continue as you would on a no-flap final approach.

6.9. Closed Traffic. Use the closed traffic pattern to get the aircraft on the ground, using a minimum amount of fuel. You may accomplish a closed traffic pattern from an initial takeoff, touch-and-go landing, or go-around.

6.9.1. Request clearance for a closed traffic pattern from the controller. Do not initiate the pattern with a straight-in approach reported between 4 and 2 miles unless cleared by the controller.

6.9.2. At a minimum of 90 KIAS and no sooner than the locally designated point, clear the area and start a climbing turn to the downwind leg. Plan your pullup, using approximately 30° to 45° of bank, so the downwind leg is displaced approximately the same distance from the runway it would be after a break. Minimum airspeed during the pullup is 85 KIAS at a maximum bank of 45°. Sixty degree of bank may be used momentarily in the pullup if a minimum of 90 KIAS is maintained.

6.9.3. When you roll out on the downwind leg, make a call to the RSU or tower (CALL SIGN, closed downwind). If you plan a full-stop landing, state your fuel remaining. Clear and continue with normal approach and landing procedures. (Lower flaps, if applicable, at the same points as in a normal pattern.) If the controller instructs you to break out, follow the local procedures for leaving traffic from inside downwind.

6.10. Final Turn Radio Call. This call is an important part of the traffic pattern procedure. It tells the controller where you are. Transmit, CALL SIGN, base as soon as safely possible after starting the final turn. Add no flap or full stop, if applicable. Transmit, CALL SIGN, base key (or as directed locally) if flying a simulated forced landing pattern. No response from the controller means you are cleared to continue with the requested approach, but be alert for other instructions from the RSU or tower.

6.11. Landing Irregularities. Up to this point, explanations of landings have been devoted mainly to ideal situations in which landings were executed correctly. However, there are several errors you might make while developing landing proficiency, so you must be thoroughly familiar with the causes, effects, and proper recoveries from these situations.

6.11.1. **Low Final Approach**. There are different ways to descend below the desired flightpath. You can start the final turn too late, place the final turn too far from the runway while maintaining normal pitch and descent rates, or dive the aircraft through the final turn. The result is excessive altitude loss and a final approach below the desired approach path. Such a situation requires additional power to fly the aircraft to the runway. You should avoid a dragged-in final approach.

6.11.1.1. A dragged-in final approach is dangerous because you may misjudge the extra power needed to fly in this attitude. Once you are accustomed to the amount of power normally required on final, habit may cause you to use only this amount. With inadequate power in this nose-high, level-flight condition, the aircraft may stall.

6.11.1.2. Adjust pitch and power as soon as you start getting low on final approach, then readjust pitch and power when you are back on the proper glideslope. If you have any doubt about the approach (that is, if it looks wrong or feels wrong), go around.

6.11.2. **Steep Final Approach**. This approach is caused by placing the final turn too close to the runway, starting the final turn too early, or keeping the nose too high in the final turn. If you continue a steep final approach, you will have a high descent rate with a low power setting. This low power setting, coupled with the pitch change required to intercept the normal glidepath, results in a rapid decrease in airspeed and a high sink rate. If you do not correct early or go around, this power deficient situation could result in a very firm touchdown or a stall.

6.11.3. **Too Slow on Approach**. When you fly too slow on the final approach, you may have an inaccurate perception of the proper glidepath and roundout height. The point to begin the roundout is lower with low airspeed and requires more precise judgment. Also, the aircraft may stall, depending on the pitch attitude, flap setting, and (or) control inputs, especially if the wind is gusty. When you are slow on final, you have much less margin for error. When you recognize a slow approach, make the same recovery as for a low final approach. Apply power at an altitude high enough to reestablish the correct airspeed and attitude or go around.

6.11.4. **Rounding Out Too High**. Sometimes when the ground stops moving toward you, your roundout has been too rapid and you are too high above the runway. To compensate for this, release a slight amount of back pressure until the aircraft starts descending again. Then continue the roundout. Use this technique only when you have adequate airspeed and runway. If you have reached a landing attitude and are still well above the ground, don't wait for the aircraft to start descending again. Go around and plan another approach. Remember, when in the landing attitude, the aircraft is rapidly approaching a stall. As the airspeed decreases, you are approaching the critical AOA.

6.11.4.1. As you lower the nose for a descent, the pitch change causes a momentary decrease in lift. This is also true during a roundout. Do not lower the nose to increase the rate of descent when you are fairly close to the runway. The momentary decrease in lift may cause the aircraft to land on the nose wheel, collapsing it. You should go around any time you feel the need to lower the nose excessively to avoid a stall during the roundout. The need for substantial lowering of the nose is an indication you are too high above the ground and approaching a stall.

6.11.4.2. Any time you approach a stall after ballooning or bouncing, apply full power, adjust your pitch to the landing attitude, and go around. It is unsafe to continue the landing. However, if you have applied power to go around and the aircraft continues to settle, do not try to hold the aircraft off by raising the nose above the landing attitude. Hold the landing attitude and let the aircraft settle to the runway. Runway contact will be moderate if you have added power, and you will be safely airborne again shortly.

6.11.5. **Rounding Out Too Late or Too Rapidly**. If you are late in starting the roundout and pull the stick back too rapidly in an effort to prevent a touchdown, you can cause an accelerated stall. This is a dangerous situation which may cause an extremely hard landing on the main gear. This may or may not be a controllable situation, depending on the airspeed. If it occurs, immediate use of power will increase thrust, lift, and controllability and will enable you to recover and go around. The important things to remember in this situation are: (1) don't panic, (2) recognize the problem, and (3) do something immediately; that is, add power and control the aircraft. In your recovery, hold the landing attitude. Your main gear will probably contact the ground a second time. But if you have initiated recovery properly, your second contact is normally moderate.

6.11.6. **Porpoising:**

6.11.6.1. This is a condition encountered during landing where the aircraft bounces back and forth between the nosewheel and main gear. It is caused by a landing attitude at touchdown, bringing the nose wheel in contact with the runway before the main gear touchdown. It most likely will occur when you attempt a landing with an incorrect landing attitude and at an excessive airspeed. If you do not immediately correct the situation, the porpoise will progress to a violent, unstable pitch oscillation. Repeated heavy impacts of the aircraft on the runway will ultimately result in structural damage to the landing gear and airframe. You can prevent a porpoise by setting the proper landing attitude immediately before touchdown.

6.11.6.2. If you begin to porpoise, immediately position the controls to establish a nose-high attitude sufficient to prevent the nosewheel from contacting the runway. Maintain this attitude and simultaneously advance the throttle to full power. Do not attempt to counteract each bounce with opposite stick movement because you will aggravate the porpoising action. Repositioning and holding the controls (restricting movement) will dampen out the oscillation. The addition of power will increase control effectiveness by increasing airspeed. It will also allow the aircraft to become safely airborne.

6.11.7. **Floating.** When you misjudge the final approach (for example, reducing the power too late, using too much power on final, or failing to use the flaps properly), your tendency is to dive toward the end of the runway in an attempt to land. When you dive, the airspeed increases. This causes you to float and possibly balloon or bounce, and you will be well down the runway before landing. To correct a slight problem of floating, gradually adjust (increase) the pitch attitude as airspeed drops and the aircraft nears landing speed. The recovery from floating will depend on the amount of floating and runway remaining. Avoid prolonged floating, especially in strong crosswinds. If you have any doubt about the recovery, execute a go-around.

6.11.8. **Ballooning.** There are several factors that cause an aircraft to balloon. Rounding out too rapidly or raising the nose to the landing attitude before lift has decreased sufficiently will cause you to balloon. The altitude gained will depend on the airspeed or the rate at which you increase the pitch attitude.

6.11.8.1. When ballooning is slight, you may complete the landing. Maintain direction, hold a constant landing attitude, and let the aircraft settle onto the runway. Use rudder pressure to keep the aircraft straight as it settles onto the runway. When ballooning is pronounced, go around. Do not attempt to salvage the landing.

6.11.8.2. Be extremely cautious of ballooning in crosswinds. If you do not maintain the wing-low crosswind correction until touchdown, the aircraft will probably balloon more because of the added lift as you level the wings. This puts you in double jeopardy because you will start drifting once you level the wings. Be sure to keep the appropriate wing down in a crosswind and maintain direction with opposite rudder. If you balloon slightly, you may need to lower the wing even further to compensate for the relative increase of drift component at the lower airspeed. Again, if you have any doubt, go around.

6.11.9. **Bouncing.** Bouncing is very similar to ballooning. What is different is the cause. If the aircraft strikes the runway hard, it will bounce into the air. The height it reaches depends on the force with which it strikes the runway and the amount of back pressure held. This height also depends on the speed at the point of touchdown. The aircraft may bounce if it makes contact with the ground before the landing attitude is attained. Avoid applying excessive back pressure when you realize, too late, the aircraft is settling too fast but is not yet in the landing attitude. Both factors tend to force the aircraft aloft again.

6.11.9.1. The corrective action for a bounce is the same as ballooning, and it depends on the severity of the bounce. When the bounce is slight and there is no great change in pitch attitude, continue with the landing. Maintain direction and set the takeoff attitude just before touchdown. When a bounce is severe; that is, you feel the aircraft rising rapidly, go around immediately. Simultaneously apply full power, maintain direction, and lower the nose to a safe pitch attitude. Follow through with the go-around even if another bounce occurs. Do not attempt a landing from a bad bounce. Remember, if you land in an extreme nose-high attitude the tail will contact the runway.

6.11.9.2. Because airspeed diminishes very rapidly as the aircraft rises, a stall may occur before the aircraft lands. Expect to contact the ground or bounce a second time during a proper recovery. The second bounce will not be as severe.

6.11.9.3. Use extreme caution any time you bounce in a crosswind. When one wheel strikes the runway, the other wheel will touch down immediately afterwards. The crosswind correction is lost, and the aircraft will drift. You should reestablish crosswind controls to stop the drift and either continue the landing or go around, depending on your situation.

6.11.10. **Landing in a Drift or Crab.** At times you may find yourself correcting for drift by crabbing on the final approach. If you round out and touch down while the aircraft is drifting or in a crab, it will contact the runway moving sideways. This will impose extreme side loads on the landing gear and may cause material failure.

6.11.10.1. After crabbing into the wind, the proper method of correcting for drift on the final approach is the wing-low method. This allows you to keep the longitudinal axis aligned with the runway throughout the final approach and landing.

6.11.10.2. During final approach, roundout, and touchdown in a crosswind, the path or track of the aircraft over the ground is a straight line in the same direction as the runway and the fuselage of the aircraft should remain lined up with the runway throughout. In other words, you should not angle toward the runway or cock the nose. Failure to apply sufficient wing-low crosswind corrections will result in landing with a drift, in a crab, or a combination of both.

6.11.11. **Wing Rising After Touchdown**. During crosswind landings, a wing may rise during the landing roll. Depending on the amount of crosswind and degree of corrective action, you might lose directional control.

6.11.11.1. When an aircraft is rolling along the ground in a crosswind, the upwind wing is receiving greater impact of air pressure than the downwind wing because the fuselage blocks the wind over the downwind wing. This causes a lift differential. The wind also strikes the fuselage on the upwind side. This causes a rolling moment about the downwind main landing gear, which may further assist the raising of the upwind wing. When the effects of these two factors are great enough, one wing may rise even though directional control is maintained. If you apply no correction, one wing will rise enough to cause the other one to strike the ground. Use rudder, brakes, and (or) nosewheel steering to maintain directional control. Use ailerons to keep the wings level. If a wing starts to rise during the landing roll, immediately apply more aileron toward the high wing and continue to maintain direction. The sooner aileron is applied, the more effective it is. The further you allow a wing to rise before taking any corrective action, the more aircraft surface is exposed to the impact pressure of the crosswind.

6.11.11.2. You may encounter a situation where a wing comes up coupled with a loss of directional control. Not only are the same factors attempting to raise the wing, but the crosswind is also acting on the fuselage surface behind the main wheels and is swerving the aircraft into the wind. Again, you should apply aileron to lower the high wing and stop the swerve with the most effective control. When the wings are approximately level, maintain directional control until you slow the aircraft to taxi speed or stop.

6.11.12. **Wheelbarrow Effect**. Wheelbarrowing is a condition in a tricycle gear aircraft when more weight is on the nosewheel than is on the main wheels. It can occur during a landing or takeoff roll and becomes more critical in a crosswind. An airplane in this situation will tend to pivot rapidly about the nosewheel similar to a ground loop in a tailwheel aircraft. Indications of wheelbarrowing are unstable directional control, wheel skipping, and (or) extreme loss of braking effect when you apply the brakes.

6.11.12.1. Wheelbarrowing most often occurs when a pilot lands the aircraft at a higher than normal airspeed and then tries to hold the aircraft on the runway with forward pressure on the control stick. The result is normally the loss of braking and steering capability.

6.11.12.2. During takeoff, you may begin wheelbarrowing by using excessive forward control stick pressure to hold the aircraft on the ground above normal takeoff speed. The wheelbarrow effect can occur at lower speeds during takeoff than during landing because the propeller wash increases the lifting power of the horizontal stabilizer.

6.11.12.3. To avoid wheelbarrowing, you must understand the need for proper attitude and airspeed control during takeoff, approach, and landing, particularly in crosswind conditions. If you experience wheelbarrowing, base your corrective action on the following factors: degree of development of the wheelbarrowing, pilot proficiency, remaining runway length, and aircraft performance versus configuration. Only after considering these factors should you initiate one of the following corrective measures.

6.11.12.3.1. If the aircraft is not pivoting, check the control stick slightly aft of neutral and aileron into the wind. If adequate aircraft performance is available, enough runway is available, and obstructions are not a factor, execute a go-around or continue the takeoff, whichever applies.

6.11.12.3.2. If the aircraft is pivoting, check the throttle in idle, position the control stick aft of the neutral position, and reduce braking to lighten the load on the nose gear. Check aileron into the wind and return steering and braking to normal.

Chapter 7

FORCED LANDINGS

7.1. Introduction. The successful accomplishment of a forced landing, whether you are faced with an actual situation or doing a simulated forced landing (SFL), will depend on confidence in your ability to react quickly without a sense of panic. A thorough understanding of aircraft systems, procedures, and practical application by practicing forced landings in the area and traffic pattern will help you build this confidence. In addition, your IP will discuss techniques for handling those situations leading to a forced landing (for example, engine failure, partial engine failure, etc.). Your IPs techniques, in conjunction with the information contained in this chapter, will provide a firm foundation for your hands-on training. SFLs are designed to teach you a safe and efficient way to land the aircraft in the event of an emergency requiring an immediate landing. SFLs will improve your judgment and ability to plan and increase your confidence in your own flying ability. Your IP will thoroughly brief the SFL before the flight.

7.2. Factors Affecting Forced Landings. Whether you are accomplishing an SFL or actual forced landing, the most important thing to remember is to maintain aircraft control by flying the aircraft first. As you establish the glide, first look for a place to land instead of devoting all of your attention to accomplishing any appropriate checklist procedures. Accomplishing emergency procedures is important, but never sacrifice aircraft control. Although your IP will address techniques for accomplishing forced landings, there are several factors you must consider when faced with an actual or SFL.

7.2.1. **Nature of the Emergency**. The nature of the emergency (complete versus partial engine failure, engine fire, etc.) will affect your decision regarding whether to land immediately, find the nearest suitable field, or attempt a return to the home field.

7.2.2. **Altitude**. Your initial altitude, coupled with the nature of your emergency, will affect the type of pattern you fly. You will have to decide whether to attempt a 360° pattern, modify your 360° pattern (set up from a low or base key), or fly straight ahead.

7.2.3. **Winds.** You must consider the direction of the wind at altitude and on the surface. Although your IP will address the direction and effect of the winds during the flight briefing, you can also determine the wind direction from other sources of information. In the traffic pattern, the windsock, RSU, and tower (if applicable) will provide good indications of surface winds. In the area, use blowing smoke or dust and ripples on a pond or lake to determine the direction of the wind. Ideally, you should land into the wind. However, landing crosswind in a long field is generally better than attempting a landing into the wind in a short, rough field. You must also consider the effect of wind on gliding distance when planning a forced landing. For example, if you are gliding at 80 knots TAS toward a field and into a 20 knot headwind, your groundspeed is 60 knots. If you turn downwind, your groundspeed is 100 knots. Therefore, you will lose almost twice as much altitude gliding into the wind (to cover the same distance) as gliding downwind.

7.2.4. **Obstructions.** The location of synthetic obstructions (towers, power lines, telephone poles, buildings, etc.) and natural obstructions (trees, hills, etc.) will affect how you accomplish your forced landing pattern and the field you select for landing.

7.2.5. **Selecting a Field**. Always be on the lookout for a suitable forced landing field because you never know when an emergency requiring a forced landing will occur. Naturally, the best forced landing field is an established airfield (concrete or asphalt surface). A smooth, hard-packed field (grass or dirt airstrip) is probably the next best substitute. However, because there is no guarantee of being near an established or hard-packed field in the event of a forced landing, you must learn to select any available field. A long, smooth field with no high obstacles around its boundaries (at least not on the approach to the field) is a good option. Cultivated fields are acceptable, but you should attempt to land parallel to the furrows to prevent possible structural damage to the aircraft. Use caution if you must select a field used for pasturing because they are normally uneven and may contain large rocks and, possibly, farm animals. If possible, avoid fields containing large ditches or deep, contour plowing. You must also consider the slope of the terrain. A field with a gentle upslope is preferred to one with a significant downslope because of the effect of your landing roll. During training, you will always select a forced landing field as you enter the area. A common mistake during SFLs is to select a perfect field that is too far away. Remember, it is usually better to select the closest suitable field that will allow for the greatest margin of error. In addition, always select a backup field in the event you miscalculate your glide or the winds.

7.3. Forced Landing Patterns. Use your altitude at the time of engine failure as the most important factor in deciding what kind or pattern you will fly. You will practice both high and low altitude SFLs in the area and in the traffic pattern. During SFLs, clear the engine approximately every 500 feet by advancing the throttle a minimum of 300 RPM. Plan to go around (unless planning to touchdown on a runway) at a safe altitude based on such factors as terrain features, wind conditions, obstructions, density altitude, aircraft performance, and individual proficiency. In any case, do not descend below 200 feet AGL while in the area. (Your instructor will direct you to go around so you do not go below the minimum altitude.) Because your actual height above the ground in the area may be difficult to determine, you should rely on outside references as well as your altimeter. Go-around procedures are the same as from final or landing phase in the traffic pattern. Climb straight ahead to 400 feet AGL. Then turn, if necessary, toward another suitable landing field in case you must make another forced landing.

7.3.1. **The 360° Pattern**. If altitude permits, use the full 360° pattern because it is easily adjustable for varying wind conditions, provides a large margin for errors in planning, and is similar to the traffic pattern with which you are already familiar. This pattern is basically a 360° descending turn which is flown in relation to ground reference points, called key positions, selected during the pattern. If the pattern is flown so the aircraft is placed over the low key and base key ground positions at the recommended altitudes, you should have a successful forced landing in the selected field. Although approximate altitudes are specified at the key points, use the landing field as the primary reference for flying the pattern. The altimeter may not give you valid information unless you know the terrain elevation.

7.3.1.1. To accomplish the 360° pattern, fly directly to the field, planning to arrive over the center of the field at approximately 1,500 feet AGL, headed into the wind (figure 7.1). This point is called high key.

7.3.1.2. When at high key, begin a gliding turn in either direction toward low key. (As a technique, try to plan this turn to keep the selected field on your side of the aircraft, thus improving your view of the landing area.) Low key is a position approximately 800 to 1,000 feet AGL and 3/4 mile from and abeam of the intended touchdown point (no wind). Low key is similar to a point in the traffic pattern on downwind just prior to the perch point.

7.3.1.3. Continue the turn from low key to base key, planning to arrive there at approximately 600 to 700 feet AGL. Base key is similar to the final turn position in the traffic pattern. From base key, turn to final approach. On final, you should normally set your aim point approximately in the center of the landing field. When lowering full flaps, change your aim point so you land in the first third of the field.

7.3.2. **Low Altitude SFLs**. Low altitude SFLs do not differ appreciably from other forced landings except there is less time available for planning and execution because of the close proximity to the ground. If altitude prevents you from arriving over the field at high key, try to enter the SFL pattern at one of the other key points. Normally, turn only as necessary to avoid obstructions when below 400 feet AGL and limit turns to approximately 90° when below 800 feet AGL.

7.3.2.1. In the area, the IP will simulate engine failure at traffic pattern altitudes. You should use the procedures already described to maneuver into position to make your forced landing.

7.3.2.2. In the traffic pattern, your IP will simulate engine failure on downwind. Procedures are the same as previously described except you should plan the pattern so the runway is your landing field. Plan to roll out on final at least 200 feet AGL. Use flaps as required. It is not necessary to touch down within the landing zone. However, if a long landing will result in a traffic conflict

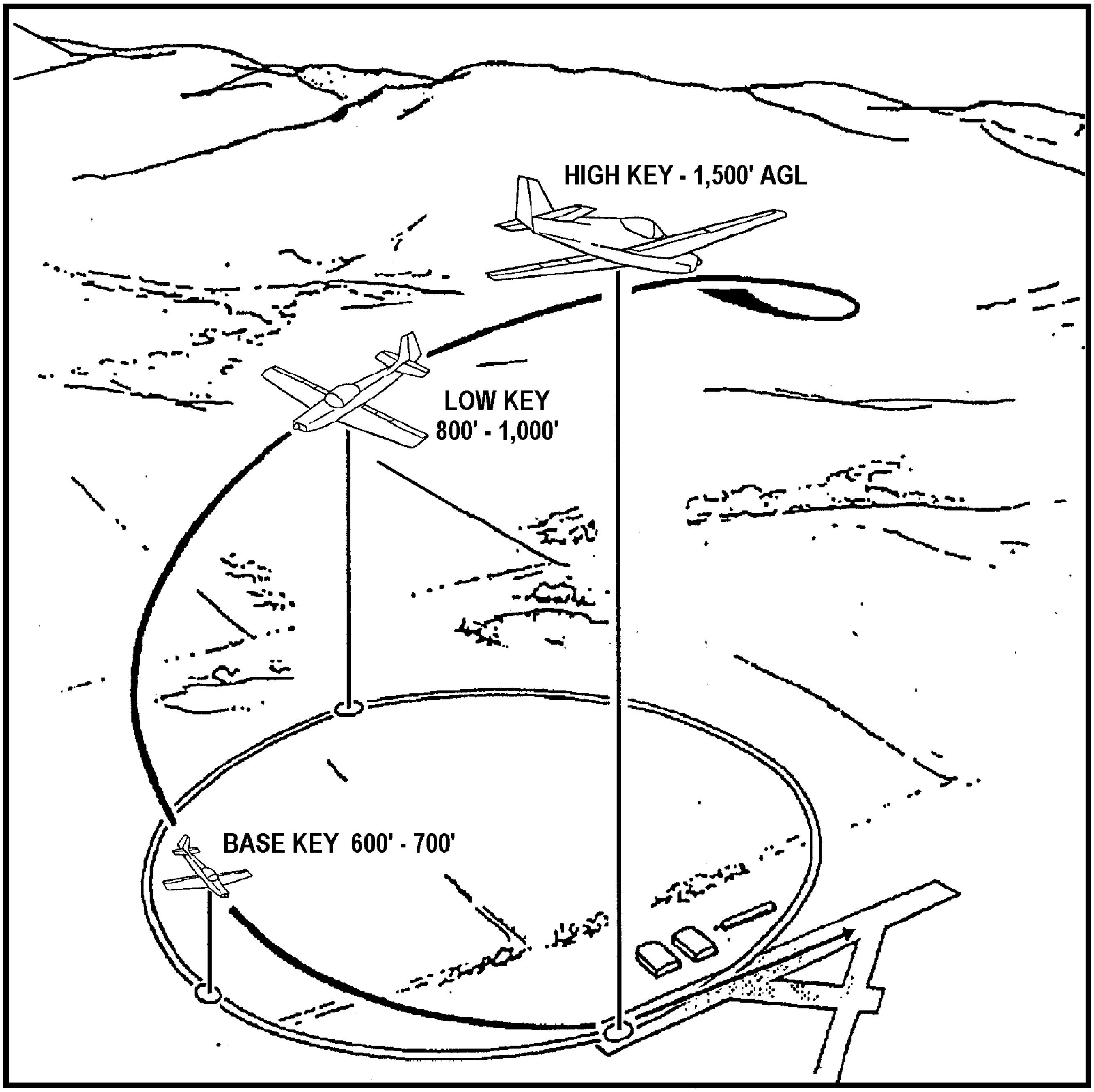

Figure 7.1. A 360° Forced Landing Pattern.

or insufficient runway remaining, execute a go-around.

7.3.3. **Use of Flaps**. Lower flaps at anytime during an actual or SFL. Plan your pattern so you do not have to retract the flaps after lowering them.

7.3.4. **Aim Point**. You aim for approximately the center of the selected field on a forced landing for two reasons. First, if the engine seizes and the propeller stops turning at the fully fine or low AOA position, the aircraft will not glide as far due to propeller drag. (The propeller should normally go to the fully coarse or high AOA position, which creates negligible drag.) Second, aiming at the center of the field allows you a greater margin for errors.

7.4. Actual Forced Landings. The purpose of your practice and instruction in SFLs is to prepare you to make a successful forced landing during an actual emergency. You improve your chances of making a successful forced landing if you remain calm. You can make an actual forced landing with little or no damage to the aircraft and no personal injury if the aircraft touches down under control.

7.4.1. Make your landing with full (40°) flaps if possible, especially on an unprepared surface and plan to touch down at the lowest possible speed. After touchdown, hold the control stick aft to keep the weight off the nosewheel as long as possible. Abandon the aircraft immediately after it comes to a stop; do not return unless you need to obtain equipment or supplies (for example, survival gear). Remain well clear of the aircraft until you are reasonably certain it is safe to return.

7.4.2. Although you may practice SFLs in the traffic pattern using the runway as the selected field, an actual forced landing in the pattern may not allow you to land on the prepared surface. For example, on takeoff leg, you will probably not have sufficient altitude to glide back to the runway. In this case, a forced landing straight ahead with the aircraft under control is much safer than attempting to turn back to a prepared surface. Besides the potential for a midair collision with aircraft behind you, you will also be faced with a downwind landing. The steep bank angles required for a 180° turn back to the runway will increase your stall speed without sufficient altitude for a recovery.

Chapter 8

SPIN TRAINING PROGRAM

8.1. Purpose. The spin training program should focus on increasing the IP's understanding of T-3A spin characteristics and the aircraft's reaction to changes in the position of the flight controls.

8.2. Spin Demonstration Sortie. Spin demonstration sorties will be flown by a wing or squadron T-3A spin pilot with students in pilot instructor training (PIT) and instructor pilots (IP) only. These sorties are designed to allow the spin pilot to demonstrate maneuvers to ensure the IP has a complete understanding of aircraft reactions in different situations. If time and fuel permit, the IP (or PIT trainees) may perform and instruct a spin prevent and a spin recovery.

8.2.1. Prior to the demonstration sortie, the IP should review the following:

8.2.1.1. Spin entry procedures and spin restrictions.

8.2.1.2. Spin prevent and spin recovery procedures.

8.2.1.3. T-3A spin characteristics.

8.2.1.4. Aircraft reactions to changes in the position of the rudder and elevator.

8.2.1.5. Characteristics encountered through improper application and handling of the controls during entry, in the spin, and during recovery.

8.2.1.6. Weather conditions affecting spin training.

8.2.2. The ground briefing prior to the sortie should include the following:

8.2.2.1. Objectives of the flight.

8.2.2.2. Details of each maneuver to be accomplished and the sequence in which each will be performed.

8.2.2.3. An explanation of the expected aircraft reaction in each of the demonstrations.

8.2.2.4. Emphasis on the fact that although some of the demonstrations will result in recovery, they will not always be successful and should not be used as **normal** methods of recovery.

8.2.3. Where indicated the IP/trainee will repeat the spin pilots demonstrated maneuver. Fly the demonstrations in the following sequence:

8.2.3.1. G-awareness exercise.

8.2.3.2. Stability demonstration. (IP/trainee repeats this maneuver.) This maneuver demonstrates the aircraft will not enter a spin unless it is in an aggravated stall. At 140 KIAS, set the manifold pressure at 15 to 20 inches of Hg, raise the nose to 70° of pitch, and allow the airspeed to dissipate as the controls are neutralized.

8.2.3.3. Spin entry attempted with neutral rudder. (IP/trainee repeats this maneuver.) This maneuver demonstrates that if yaw is not introduced during a stall, the aircraft should not enter a spin. Attempt a normal spin entry, using only enough rudder to ensure proper coordination into the stall. As the aircraft reaches the stall, ensure the ailerons are neutral and the stick is full aft. The stall should be characterized by a slight nose drop and an increasing sink rate. Some wing rock may be encountered. Do not attempt to counter the wing rock with aileron inputs unless the bank becomes excessive. Execute a stall recovery when the demonstration is complete.

8.2.3.4. Attempted neutral control recovery. This maneuver demonstrates that after the aircraft has entered a spin, neutralizing the controls may not effect a recovery. Enter a spin and place the controls in the neutral position approximately 3 seconds after rotation begins. In most cases, the neutral control position will not overcome the momentum built up during entry and the aircraft will not recover. When neutral controls fail to effect recovery, the nose of the aircraft remains below the horizon and rotation stabilizes at an increased rate due to insufficient control application. These characteristics are similar to those that occur during a missed spin prevention. When these characteristics are recognized, perform a spin recovery.

8.2.3.5. Rudder reversal. This demonstration shows the reaction of the aircraft to rudder application during the spin. Do not reverse rotation during the demonstration. Enter a spin and hold the prospin rudder until the spin is fully developed. Apply full rudder opposite the direction of spin while holding the stick full aft. Notice this results in the nose lowering and a momentary increase in the rate of rotation, followed by a marked decrease as the rudder becomes effective. At this time, apply full prospin rudder. Due to the sudden change from antispin rudder and the corresponding reduction in the rudder's effective surface area, the nose rises and the rate of rotation rapidly returns to a stabilized state. To recover from this demonstration, perform a spin recovery.

8.2.3.6. Snap roll recovery demonstration. (IP/trainee repeats this maneuver.) This maneuver exposes the pilot to the aircraft characteristics encountered frequently during poorly flown student maneuvers. At approximately 120 KIAS, reduce the power to idle and remain in level flight or enter a shallow climb. As the airspeed dissipates below 90 KIAS, smoothly apply full aft stick and full rudder in the desired direction of roll. Use spin prevention controls to recover the aircraft. This demonstration shows the pilot that during a potentially disorienting departure, the aircraft can be recovered in a very controlled manner, using spin prevention procedures. Do not attempt to enter a spin from this maneuver.

8.2.3.7. Maneuver departure. (IP/trainee repeats this maneuver.) This demonstration shows the aircraft's reactions in a high-energy departure. Simulate an entry into the break turn at 120 KIAS and 60° of bank, retarding the power to idle and pulling approximately two Gs. At the first stall indication, apply full rudder opposite the direction of turn. As the spin develops, use spin prevention procedures to recover. When the aircraft stalls at a relatively high airspeed, the spin entry will tend to be more oscillatory and the spin will take longer to develop. Spin prevention controls should be effective at any spin stage prior to stabilization. If full antispin controls are achieved and rotation stabilizes at an increased rate, perform a spin recovery.

8.2.3.8. Attempted full power spin. This maneuver will demonstrate the effects of improper power usage during a spin. Enter a spin with full power. As the spin develops, the IP should notice a shallower pitch attitude and an increased rotation rate (due to aerodynamic blanketing of the vertical stabilizer). After these characteristics are noted (three rotations maximum), perform a spin recovery.

8.2.3.9. Attempted reverse recovery. This demonstration will show the spin characteristics experienced when recovery controls are applied in the wrong order. Enter a spin and allow it to develop. Maintain full prospin rudder and slowly apply full forward stick (in about 4 seconds). The rotation rate will increase as the nose lowers due to the conservation of angular momentum. When these characteristics are noticed, immediately apply full antispin rudder. This input should decelerate the spin enough to effect recovery. If recovery is not effected in four rotations, execute missed recovery procedures.

8.2.3.10. Secondary drill exercise. This maneuver demonstrates to the trainee the effectiveness of the secondary drill. This maneuver also familiarizes the trainee with the stick forces required to move the stick forward of neutral with prospin rudder. The trainee enters a spin and allows it to develop. The trainee maintains full prospin rudder and slowly applies full forward stick (about 4 seconds). The rotation rate will increase as the nose lowers due to the conservation of angular momentum. When the trainee notices these characteristics as well as the increased stick forces required, he or she will immediately apply antispin rudder. One turn after applying antispin rudder, the trainee will perform the secondary drill.

8.2.3.11. Attempted rudder only recovery. This maneuver demonstrates the effect rudder has on pitch attitude and rate of rotation when the stick is released in the spin. Enter a spin and hold full prospin rudder as the spin develops. Release the stick and note that it will move slightly forward and toward prospin aileron. The nose should lower and the rate of rotation should increase slightly. Observe these characteristics for approximately two turns, then apply full recovery rudder (as the stick "free-floats"). The nose will lower, the stick will move forward, and the rotation rate will initially increase, then decrease, and stop as the spin is broken. If the rotation continues, perform a spin recovery. This demonstration and the reverse recovery demonstration show that even if incorrect control inputs are used during a spin recovery attempt, if full antispin rudder is used, the aircraft should recover.

8.2.3.12. Student induced errors. The spin pilot will expose the trainee to spin recovery errors and inadvertent departures. The spin pilot will evaluate the trainee's response and ability to correct the errors. When the trainee detects spin pilot induced errors, he or she will intervene as appropriate and take action to recover the aircraft. Spin pilots will not allow excessive spin acceleration, excessive altitude loss, or deterioration of the situation into a missed spin recovery/spin prevent. These maneuvers can be performed after the G-awareness exercise to increase their effectiveness. The spin pilot will introduce the following errors:

8.2.3.12.1. Out of order control inputs (stick forward prior to antispin rudder application). The spin pilot will enter a spin and allow it to develop. The spin pilot will attempt to move the stick forward prior to applying antispin rudder. The trainee will recognize the error, intervene as appropriate, and effect recovery using spin recovery procedures.

8.2.3.12.2. Slow spin prevent. The spin pilot will enter a spin and initiate a spin prevent prior to stabilization. The spin pilot will move antispin controls at a rate too slow to effect a recovery. The trainee will recognize the error, intervene as appropriate, and recover the aircraft using spin prevent controls.

8.2.3.12.3. Departure from an over the top acrobatic maneuver. The spin pilot will allow airspeed to bleed off excessively as the aircraft reaches the top of a maneuver. The spin pilot will then apply back pressure as required to cause the aircraft to depart. The trainee will recognize departure, take control of the aircraft, and effect recovery using spin prevent procedures.

8.2.3.12.4. Departure from power on stall recovery. The spin pilot will perform a power on stall. During recovery, the spin pilot will enter a secondary stall with enough rudder and back pressure to cause a spin. The trainee will recognize departure, take control of the aircraft, and recover the aircraft, using spin prevent procedures.

8.3. Spin Pilot Checkout Program. The squadron commander will select the most highly qualified instructors to be spin pilots. Each spin pilot will complete the following checkout program prior to conducting any spin demonstration sorties. The chief squadron spin pilot will:

8.3.1. Maintain a folder for each spin pilot to include the following:

8.3.1.1. AETC Form 875, **Spin/Stall Pilot Qualification and Evaluation Certification** (to log ground and flight training, and spin pilot evaluation).

8.3.1.2. AETC Forms 803A, **Student Activity Record** (to record comments on the upgradee's progress after each spin pilot qualification sortie).

8.3.2. Conduct spin pilot qualification on a proficiency advancement basis:

8.3.2.1. For ground training, students will review spin information in the following:

8.3.2.1.1. G-1-1: T-3A Flight Manual.

8.3.2.1.2. G-1-2: AETCI 11-205 and this manual.

8.3.2.1.3. G-1-3: Other information as determined locally.

8.3.2.2. Conduct flying training as follows:

8.3.2.2.1. C-4-1 (any spin pilot): briefed and flown as a 4-8 month spin sortie. The spin pilot should highlight emphasis areas and instructional techniques.

8.3.2.2.2. C-5-1 (any spin pilot): the spin pilot briefs emphasis areas and instructional techniques. The upgradee flies all demonstrations and may practice skeleton instruction.

8.3.2.2.3. C-6-X (any spin pilot): upgradee briefs and flies a 4-8 spin sortie, practicing all instruction. Fly as many C-6-X sorties as necessary to ensure proficiency.

8.3.2.2.4. C-7-1 (Spin Pilot Qualification Evaluation): briefed and flown by upgradee and evaluated by chief squadron/wing spin pilot for demonstration effectiveness and instruction accuracy.

8.3.3. Forward the completed AETC Form 875 to the 12th Operations Group Vice Commander (12 OG/CCV) for certification. The 12 OG/CCV will notify 19 AF/DOV after certification.

8.4. Spin Education Program:

8.4.1. Spin pilots will conduct an annual seminar during the first quarter of each calendar year. Attendance is mandatory for all assigned and attached T-3A pilots. Instructors who miss the seminar will not spin until they are briefed on meeting minutes and are considred to be noncurrent. Document attendance and maintain records for at least 1 year according to AFR 4-20, volume 2, *Disposition of Air Force Record–Records Disposition Schedule* (squadrons determine the most suitable method for documenting).

8.4.2. Squadrons may supplement this program by using:

8.4.2.1. Inadvertent spin surveys.

8.4.2.2. Spin demonstration sorties in addition to those already required.

8.4.2.3. Increased emphasis on spins during IP continuation training meetings.

8.5. Inadvertent Departure/Spin Survey Report:

8.5.1. The operations group commander will send a quarterly T-3A Inadvertent Spin Survey Report to 19 AF/DOV by letter within 15 days following the end of each quarter. Compile the inadvertent spin data and report to include:

8.5.1.1. The maneuver being flown at the time of the inadvertent spin entry.

8.5.1.2. Category of pilot flying the aircraft (student, IP, or proficiency pilot).

8.5.1.3. Type of mission (dual or solo).

8.5.1.4. Method of recovery (spin recovery or spin prevent).

8.5.2. The method of survey is determined locally. However, the survey should include all rated and student pilots flying the T-3A. The program should be structured so survey respondents remain anonymous.

8.5.3. For reporting purposes, submit the report any time antispin controls must be applied to recover the aircraft. This does not include preplanned entries applicable to normal student training except missed recovery attempts performed by the IP.

8.5.4. On receipt of all quarterly reports, 19 AF/DOV summarizes and forwards comments to each squadron commander for dissemination to aircrews.

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Director, Plans and Operations

Distribution: F; X:
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Unit 3220, Box 385
APO AE 09094-0385

LIST OF ABBREVIATIONS

AGL	above ground level
AOA	angle of attack
COMM/NAV	communications/navigation
DME	distance measuring equipment
FCIF	flight crew information file
FOD	foreign object damage
fpm	feet per minute
GND	ground
IFF/SIF	identification friend or foe/special identification feature
IFR	instrument flight rules
IP	instructor pilot
KIAS	knots indicated airspeed
KTAS	knots true airspeed
LOC	loss of consciousness
NOTAM	notice to airmen
OBS	omnibearing selector
PIT	pilot instructor training
RPM/rpm	revolutions per minute
RSU	runway supervisory unit
SFL	simulated forced landing
SOF	supervisor of flying
TAS	true airspeed
TOLD	takeoff and landing data
TWR	tower
UHF	ultra high frequency
UFT	undergraduate flying training
VFR	visual flight rules
VMC	visual meteorological conditions
VHF	very high frequency
VOR	very high frequency omnidirectional range
VSI	vertical speed indicator

MISSION BRIEFING GUIDE

NOTE: Brief items applicable to your mission in sufficient detail to prevent any misunderstandings between crewmembers.

A2.1. General:
- Time hack
- Mission objectives and requirements
- Mission overview
- Flight Crew Information File (FCIF), ops notes, notices to airmen (NOTAM), and takeoff and landing data (TOLD)
- Weather, airfield status, and alternate airfield
- Call sign
- Signout, engine start, and takeoff times

A2.2. Mission Profile:
- Ground operations (AFTO Form 781 review and stowage, exterior inspection responsibilities, instrument cockpit check responsibilities, and spare procedures)
- Takeoff (static and rolling and crosswind procedures)
- Departure (routing, altitudes, and airspeeds)
- G-awareness exercise
- Specific area work and parameters
- Recovery (routing, altitudes, and airspeeds)
- Simulated emergency procedures

A2.3. Crew Coordination:
- Aircraft commander
- Transfer of aircraft control, with and without intercom
- Clearing
- Inflight checks
- Radio procedures
- Wake turbulence

A2.4. Emergency Procedures:
- General aircrew responsibilities during emergencies
- Emergency ground egress
- Takeoff emergencies
- Physiological incident
- Birdstrikes
- Emergency divert airfields

A2.5. Questions.

SUPERVISED SOLO TURNAROUND CHECKLIST

NOTE: As a minimum, complete the following items before the solo portion of the student initial solo sortie. Local guidance including these items, will be found in the inflight guide.

A3.1. Perform After Landing Checklist.

A3.2. Before IP Deplanes:

- Elevator trim - NEUTRAL
- Cockpit air vents - OPEN
- U/VHF radio - ground (GND), tower (TWR), or RSU, as appropriate
- AFTO Form 781 - DUAL PORTION COMPLETE
- Fuel - 20 gallons minimum
- All systems - CHECK
- Before-takeoff checklist - COMPLETE
- Student briefing - ENSURE COMPLETE

A3.3. After IP Deplanes:

- Right seat equipment - SECURE (IP)
- IP headset - STOWED
- Canopy latch - LOCKED
- Monitor tax.